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THE

AMERICAN JOURNAL

OF

SCIENCE AND ARTS.

LAWRENCE SCIENTIFIC SCHOOL
CHEMICAL DEPARTMENT

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AND

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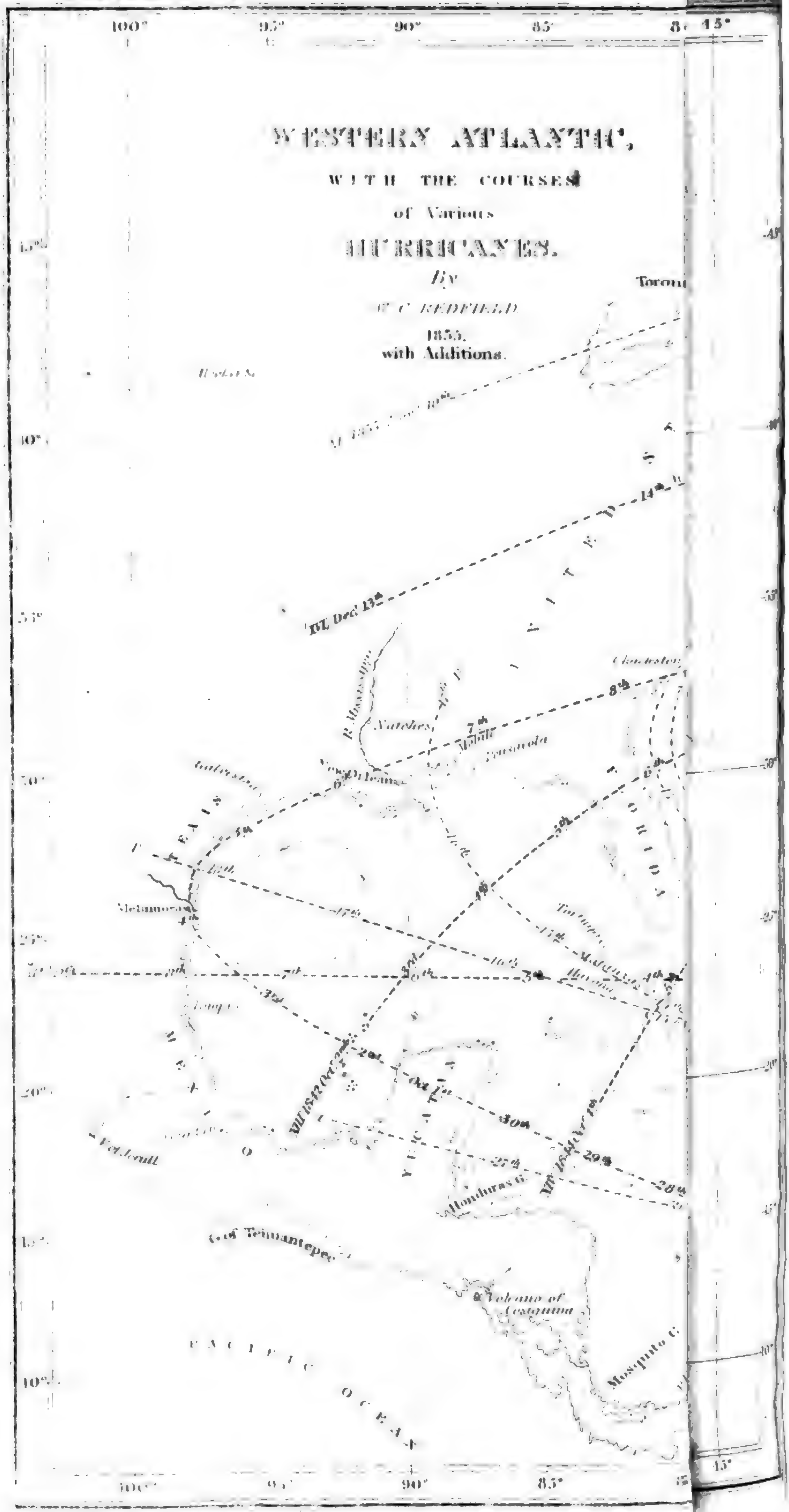
ERRATA.

Page 1, second note, for "Chart II," read "Chart I."—P. 12, line 9 from top, for "vortica," read "vortical."—P. 308, line 9 from top, for "Persia," read "Russia."—P. 314, line 17 from bottom, for "river," read "newer."—P. 312, line 8 from top, for "semi-monthly," read "bi-monthly."

CHART I.


WESTERN ATLANTIC,
WITH THE COURSES
of Various
HURRICANES.
By
W. C. REDFIELD.
1855.
with Additions.
100°
95°
90°
85°
45°
40°
35°
30°
25°
20°
15°
10°
Toron
Charleston
Natches
Mobile
Pensacola
New Orleans
Galveston
TEXAS
Matamoras
FLORIDA
Tortugas
Havana
MEXICO
YUCATAN
Honduras G.
Vera Cruz
G. of Tehuantepec
Volcano of Cosiguina
Mosquito C.
PACIFIC OCEAN
UNITED STATES
VI. Dec. 13th
14th
8th
7th
6th
5th
4th
3rd
2nd
Oct. 1st
30th
29th
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16th
11th
10th
VII 1842 Oct.
VIII 1844 Oct.

THE
AMERICAN
JOURNAL OF SCIENCE AND ARTS.

[SECOND SERIES.]

Art. I.—*On Three several Hurricanes of the American Seas and their Relations to the Northers, so called, of the Gulf of Mexico and the Bay of Honduras, with Charts illustrating the same;* by W. C. Redfield.

Introduction.

In some former investigations of the hurricanes of the Atlantic Ocean and other seas, I have been enabled to trace the progress of these tempests in a westerly direction while in the intertropical latitudes, and thence in a recurved or northeasterly direction through a portion of the temperate zone.* The routes pursued by several of these storms have been delineated on my chart of 1835, which, with several additions, is appended to this communication.†

Of the storms which have been thus examined, some have been traced in their daily progress for a distance of 2500 or 3000 miles; while the places of their first origin, as well as of their final disappearance, remain still undetermined.

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* See this Journal, (first series,) April, 1831, (Vol. xx,) Art. IV:—October, 1833, (Vol. xxv,) Art. XV:—October, 1836, (Vol. xxxi,) Art. VIII:—January, 1839, (Vol. xxxv,) Art. II, p. 201:—January, 1842, (Vol. xlii,) Art. XII.

† Chart II.

The nearly symmetrical forms of the semi-orbital curves which are shown in the routes of these storms, and their obvious relations to the observed courses of the great aerial currents, both in the intertropical and temperate latitudes, appear to warrant the conclusion that they all pertain to one prevalent system of atmospheric dynamics, and that these several storm-routes indicate, with much certainty and precision, the general or aggregated course of circulation pursued by the great currents or moving strata of the lower atmosphere, at the several periods and localities in which these storms have appeared.

Some of these storms, however, have been traced only in their westerly course in the lower latitudes, and have not been followed in a subsequent northeasterly course; but in these cases there appears no good reason to doubt the ultimate extension of the semi-orbital curve of the storm-path into higher latitudes.

The storm-routes which have been established by the inquiries of Col. Reid, on both sides of the equator, constitute an important addition to our knowledge on this subject, and are found on the charts which accompany his valuable work on the law of storms.[*] The elaborate investigations made by Mr. Piddington of Calcutta, have also contributed much to our knowledge of the courses pursued by Asiatic storms.[†] Other and distinguished writers have shown, to some extent and at different periods, a corresponding course in other tempests, while moving through a portion of the temperate latitudes, but with no clear indications of an orbital or semi-orbital course of progression in the body of the storm.[‡]

Antje's Hurricane of August and September, 1842.

Three several storms, the routes of which are marked I, II and V, on my storm chart of 1835, were traced only in their westerly course and in the lower latitudes.* To this group I have now to add the observed route of the storm which appeared in the American seas at the end of August and in the early days of September, 1842, the route of which is marked XII on the same chart.

---

[*] "An attempt to develop the Law of Storms, by means of facts arranged according to place and time;" by Lieut. Col. W. Reid, C. B., F. R. S.; Weale, London, 1838 and 1841.

[†] See eleven successive Memoirs "on the Law of Storms in India;" published by Mr. Piddington, at Calcutta. Mr P. infers that some storms of the China sea have probably pursued a southwesterly course; but we can hardly admit this anomaly without full evidence derived solely from the progress of the storm over successive and extended localities.

[‡] Since these pages have been preparing for the press, I have met with Mr. Thom's "Inquiry into the Nature and Course of Storms in the Indian Ocean south of the Equator." (London, 1845.) This interesting work fully confirms the vorticular rotation and orbital progression of the Mauritius hurricanes, in directions of revolution which are counterwise to the storms of the northern hemisphere, as had been shown by Col. Reid. It will doubtless prove valuable to navigators.

This hurricane is distinguished as having pursued a course which is nearly due west, so far as it has been successfully followed by our inquiries, and its progress and observed phenomena will now be considered.

Our earliest notice of this gale is August 30th, in lat. 25° 54′ N., lon. 63° W., where the schooner *Antje* was dismasted by it, and our latest is September 8th, in Mexico, lat. 23° 28′ N., lon. 102° W.; the meridional distance between these points being equal to thirty nine degrees of longitude.

In submitting a condensed statement of the various observations obtained, I shall first exhibit the reports from places which were on or near the right margin or border of the gale as it proceeded westward; second, those reports which relate to the left margin or southern border of the storm's path; and, lastly, those which relate to the right center and left center of the advancing gale.

Right Margin of the Gale.

1. From Bermuda, which is over 400 miles† N. 13° W. from the position assigned to the Antje on the 30th of August, and apparently beyond the direct influence of the gale, we have the following observations.

Date.		Hours.	Winds.	Force of wind.	Aspect of weather.	Barometer.
August	30.	noon.	W. N. W.	2 (light breeze.)	blue sky.	30·07 inches.
	31.	noon.	W.	2 " "	blue sky.	30·11 "
September	1.	5 A. M.	N. E. by N.	6 (single reef gale.)	cloudy.	30·05 "
	"	noon.	N. E.	4 (moderate breeze.)	cloudy.	30·09 "
	"	9 P. M.	N. E.	6 (single reef gale.)	cloudy and rain.	30·09 "
	2.	noon.	N. E.	5 (fresh breeze.)	blue sky.	30·13 "

[We find here a moderately high barometer throughout, with light and faint winds on the 30th and 31st. On the 1st of September, when the gale should have passed far to the westward in its course, we have fresh winds from northeast, which winds existed in like force, at that time, as far west as the American shores and over a large extent of country, north of Florida and bordering on the Gulf of Mexico.][*]

---

* See Chart I.

† The miles referred to in this paper will be statute miles of 5280 English feet, unless otherwise expressed.

2. Savannah, Geo., lat. 32° 05′, lon. 81° 07′, Sept. 1st, wind N. E., A. M. cloudy, P. M. fair; 2d, cloudy, A. M., wind E., P. M. N. E.; 3d, wind N. E., fair; 4th, wind N. E., P. M. cloudy; 5th, fair, A. M. wind E., P. M. S. E.[†]

3. St. Augustine, E. Florida, lat. 29° 40′, lon. 81° 35′, Sept. 1st, fair, with high winds from E.; 2d, cloudy, high winds from N. E.; 3d, wind N. E.; 4th, *rain A. M., fair P. M., wind N. E.;* 5th, fair, wind N. E.; 6th the same.

4. Palatka, East Florida, on the river St. John, lat. 29° 38′, lon. 81° 47′, Sept. 1st, wind E., cloudy, N. E., fair; 2d, wind W., fair, N. E., rain; 3d, wind N., cloudy, N. E., fair; 4th, *wind N. E., fair;* 5th and 6th, wind N. E., fair.

5. Fort Micanopy, East Florida, lat. 29° 5′, lon. 82° 5′, Sept. 1st, A. M. wind N. E., fair, P. M. N., rain; 2d, A. M. wind E., P. M. N. E., fair; 3d, S. E., fair; 4th, *N. E., fair;* 5th, *S., fair;* 6th, S. E., cloudy.

6. Fort Brooke, Tampa Bay, (west coast of Florida peninsula,) lat. 27° 57′, lon. 82° 35′, Sept. 1st, wind E., P. M. cloudy; 2d, E., fair; 3d, E., P. M. cloudy; 4th, A. M. N. E., fair, P. M. *E., rainy;* 5th, *E., cloudy;* 6th, E., fair.

7. Cedar Keys, East Florida, (northeast angle of the Gulf of Mexico,) lat. 29° 9′, lon. 82° 56′, Sept. 1st, A. M. wind S. W., fair, P. M. N. E., rain; 2d, E., fair, P. M. rain, high winds; 3d, E., fair; 4th, E., fair; 5th, A. M. *N. E.,* P. M. *E., fair;* 6th, E., fair.

8. Fort Fanning, Florida, lat. 29° 38′, lon. 83° 9′, Sept. 1st, A. M. wind S., fair, P. M. E., rain; 2d, S., fair; 3d, A. M. N. E., P. M. E, fair; 4th, A. M. N., P. M. E., fair; 5th, A. M. S. E., P. M. S., fair; 6th, E., fair.

9. Fort Stansbury, Middle Florida, lat. 30° 18′, lon. 84° 8′, Sept. 1st, wind E., rain; 2d, A. M. E., P. M. S. E., rain; 3d, A. M. S. E., P. M. E., cloudy; 4th, E., fair; 5th, A. M. N., P. M. S., fair; 6th, A. M. E., P. M. S. E., fair.

10. Fort Pickens, Pensacola Bay, West Florida, lat. 30° 18′, lon. 87° 12′, Sept. 1st, wind N. E., rain; 2d, A. M. N. E., rainy, P. M. E., cloudy; 3d, A. M. N. E., P. M. E., cloudy; 4th, A. M. E., P. M. S. E., fair; 5th, E., fair; 6th, E., fair; 7th, S. E., fair.

11. Fort Morgan, Mobile Bay, Ala., lat. 30° 16′, lon. 88° 10′, Sept. 2d, A. M. wind S., fair, P. M. S. E., rain; 3d, S. E, rainy; 4th, S. E., fair; 5th, S. E., fair, rainy P. M.; 6th, S. E., fair; 7th, S. E., fair; 8th the same.

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[*] Capt. Beaufort's symbols for denoting the strength of winds and the state of weather, which are very generally adopted by English authorities, and to which we must often refer, are substantially as follows:—

The scale of the winds is from 0 to 12, the first indicating a calm and the last the full force of a hurricane. These numbers are not used with precision, but 5 and 6 may be viewed as pertaining to a storm-wind, when found in proximity with a gale or hurricane and in directions which are accordant with its winds, and even 4 or 3 may sometimes be thus viewed.

The state of the weather is denoted as follows:—

b. Blue sky, with or without clouds.
c. Detached or opening clouds.
d. Drizzling rain.
f. Fog.
g. Gloomy dark weather.
h. Hail.
l. Lightning.
m. Misty or hazy, intercepting view.
o. Overcast with impervious cloud.
p. Passing showers.
q. Squally.
r. Continuous rain.
s. Snow.
t. Thunder.
u. Ugly and threatening appearance.
• Under any letter denotes an extraordinary degree.

The reader will find frequent occasion to refer to this note.

[†] Most of the following observations in the United States are from the returns made to the Surgeon General's Office, from the military posts, kindly furnished by Surgeon General Lawson.

The scale of the wind's force prescribed for the United States military posts consists of ten numbers, in which 9 denotes a hurricane force, and 10 a violent hurricane. Thus a like force may be sometimes expressed by a number which is lower by two than in the English scale, which is next mentioned, so far as relates to the higher numbers.

There are some observers who use a scale of only six numbers to express the force of the wind, instances of which will occur in this article.

12. New Orleans Barracks, La., lat. 30°, lon. 90° 9′, Sept. 2d, wind N. E., P. M. rainy; 3d, N. W., P. M. rainy; 4th, N., cloudy; 5th, N. E., cloudy; 6th, A. M. N. E., P. M. S. W., cloudy; 7th, A. M. N. W., P. M. S. W., cloudy.

13. Fort Jessup, La., lat. 31°, lon. 93°, Sept. 3d, wind S., fair; 4th, S., fair; 5th, S., cloudy; 6th, S. E., cloudy; 7th, S. E., cloudy; 8th, A. M. N., P. M. S., cloudy.

With reference to the foregoing observations it is well to state here that the body of the hurricane passed over the southern part of the peninsula of Florida on the 4th day of September, on its route to Mexico. From the 1st to 4th a rain passed over part of Florida in a nearly opposite direction.

Left Border of the Gale.

14. Nassau, N. P., (Bahamas,) Sept. 10th.—The brig *Rolla*, from Glasgow, arrived this morning, having touched at Antigua. She encountered none of the severe weather which was experienced here and at the adjacent islands on the 2d and 3d instant. On the contrary it was a perfect calm. [We must suppose that this vessel first made the latitude of Antigua and then ran to the westward in the usual way. Thus the storm might pass down to the westward on a more northern parallel, without being noticed by the *Rolla* either before or after her arrival at Antigua. See Chart II.]

15. We come next to the well kept log of H. M. S. *Pilot*, then on her passage from Jamaica to Nassau, N. P., the full insertion of which our limits preclude. The *Pilot* was westward of Hayti on the second and third of September, when the gale passed her meridian, working up for the passage between Hayti and Cuba, with easterly and variable winds, moderate in force, "and just feeling it enough to make her testimony highly interesting," as shewn by the following extract: "Sept. 2d, A. M., wind N. E.; out first reef of topsails, set royals and flying-jib: Noon, Cape Maize, [E. end of Cuba,] bore N. 22° E., distant 90 miles; at 2 P. M. taken aback, wind N. N. E.; turned round on the starboard tack; 3 P. M. in royals; 3h 40m. set royals; 5 P. M., wind southward; 7 P. M., wind S. W., in royals; ends calm. Sept. 3d, light variable winds, N. W. to E.; 5 A. M., a breeze from E.; 6 A. M., E. b. S.; 10 A. M., E. S. E.: Noon, Cape Maize, N. 2° W. 58 miles; wind light from E.; 7. P. M., in royals, flying-jib and reef in topsails, wore ship, in top gt. sails; 9h. 50m. P. M., set fore-topmast staysail, down jib, up foresail, lowered topsails to a squall; 11h. 40m. in two reef fore-topsail. Sept. 4th, 1 A. M. hoisted topsail, set foresail, wind S. E. varying to W. and calm, no stars visible; A. M., winds S. E., to E. by N." On the 4th and 5th, from E. end of Cuba to Fortune Island, winds light and moderate, from S. to S. E. [I consider the changes of wind on the afternoon and night of the second as due to the influence of the gale in passing; and the squally or cloudy weather on the night of the 3d as due to the recurrence of the lower trade wind, as disturbed by the passage of the storm on the N. side of Cuba.]

16. From the logbook of H. M. S. *Ringdove*,* sailing from Vera Cruz to Laguna des Terminos on the southern side of the Gulf of Mexico:—Sept. 5th, calms and variable winds in the forenoon, lat. 19° 15′, lon. 95° 8′; P. M., winds northerly, force 4 and 5; Sept. 6th, latter part of night calm, A. M. winds N. N. E., N. W. and westerly, lat. 19° 9′, lon. 93° 31′, P. M. wind W. N. W., 3; Sept. 7th, winds W. S. W. and S. W. by W., 3, lat. 18° 37′ lon. 91° 45′; P. M., light, variable, 1, and calm. On the 8th the wind freshened from S. E.; with a heavy swell from S. E. on the 9th. [The storm appears to have passed the meridian of the *Ringdove* on the 7th, but at a considerable distance to the northward.

17. At Vera Cruz, lat. 19° 12′, lon. 96° 04′, there was no gale at this period.

18. At Tampico, lat. 22° 15′, lon. 97° 50′, the gale was not felt in any force, although this point was near the left centre of the storm. [Had we barometrical observations from

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* The logs of the *Pilot* and *Ringdove*, with those of other British ships of war, were kindly furnished by Col. Reid, of the Royal Engineers, now Governor of Bermuda.

Tampico they might serve to show the true state of the storm at that point, which from its position on the eastern coast is sheltered from the force of the westerly winds, which constituted the left hand side of the storm.]

After careful inquiry I cannot find that this gale appeared to the southward of the chain of islands which forms the northern boundary of the Caribbean Sea, nor in that southern portion of the Gulf of Mexico which is known as the Gulf of Campeche.

We will now follow the course of the storm, directly in its path of violence.

Right and Left Center of the Gale.

19. Our first report is that of the Dutch Schr. *Antje*, already mentioned as having been dismasted, Aug. 30th, in lat. 25° 54′, lon. 63°, "in a violent gale from S. and E." [Perhaps this report of the wind's direction is intended for southeastward; *i. e.* "*southward and eastward*," as the phrase is often used by seamen. It is probable that the date is given in nautical time, and applies more especially to the time of the casualty. Thus it *may* refer to the afternoon of the 29th, and to the latter part of the gale. This will agree better with the next report.]

20. At Turk's Island, lat. 21° 30′, lon. 71° 4′, Aug. 30th, "heavy tempest from S. to S. W."

21. The Brig *Helen and Elizabeth* reports a hurricane on the evening and night of Sept. 2d, at Rum Cay and Watling's Island. The latter island is in lat. 24°, lon. 74° 28′, and the effects of the gale were here most disastrous; not a house on the island but had been more or less seriously injured, and most of them were in ruins.

22*a*. A Nassau account, already quoted, shows that the hurricane passed over the Bahama Islands on the 2d and 3d of September. The loss of life and property at these islands is represented to have been very great.

A comparison of the above accounts and positions will show that the Turk's Island date is given erroneously, perhaps in nautical time. These reports are sufficient, however, to show the arrival of the gale on the evening of Sept. 2d at the eastern portion of the Bahama Islands. From these islands to the center of the Gulf of Mexico the reports are sufficiently numerous and full for the objects of this inquiry. The next report, though much abridged, affords a good account of the access and progressive phases of the storm, first on the northern margin and then in the more central portion of its track; showing the direction and modifications of the wind successively induced as the ship and the storm advanced westward in their respective, and, in part, coincident courses.

22*b*. Ship *St. Mary*, Foster, for New Orleans, at noon of Sept. 2d was in lat. 27°, lon. 76°, [then in advance of the northern border of the gale,] "a favorable N. E. wind wafting the ship swiftly to the southward." . . "Low fleecy clouds flew swiftly to the west;" "*a high sea, without any apparent cause*, rolling furiously from E. N. E." On the morning of Sept. 3d, [front centre of the gale then nearly as far westward as the ship,] the wind increased, the east sea had swelled to mountains, the sun shone silvery bright, and the clouds displayed fiery copper tints. At 8 A. M. passed near the Hole in the Wall, [S. E. end of

Abaco, lat. 25° 51′, lon. 77° 11′,] tem. of air 82°, water 81½°, wind increasing, in sudden gusts; sails reduced and well secured. Shortly after noon of the 3d, passed Stirrup Key and entered upon the great Bahama Bank. The wind, from E. N. E., continued to increase, but was fair for crossing these smooth shallow waters. Appearances now altered and the clouds flew to the west with great velocity and low elevation; ship reduced to close-reefed topsails and reefed fore courses. At half-past 8 P. M., departed from the Bank and encountered, in the Gulf of Florida, a heavy breaking sea. The night was dismal in the extreme, but the ship scudded with safety.

After daylight on the 4th, the sea ran very dangerously, and during the morning the clouds came flying from the east with heavy squalls of wind, lightning and torrents of rain. By 10 A. M. the Florida Reef, near to Loo Key, was seen, over which the sea was breaking frightfully, the wind blowing E. by S. About noon the wind had increased to a perfect hurricane; to run was no longer safe, and the ship was hove to with head to the south, under a storm mizen topsail, which soon blew to fragments. At 6 P. M. had drifted into shoal water, but to set sail was impossible, as no canvass could stand, and for four anxious hours the ship drifted to the west. The wind during that long night blew steadily from E. by S. with increasing violence. Towards morning of the 5th it veered gradually to the S. E. and moderated to a hard gale, with heavy rain. Finally, the morning of the 6th brought, in the Gulf of Mexico, a clear sky and a gentle breeze.—(*Jour. of Capt.* FOSTER.)

[The veering of the wind from N. E. to S. E., to the *right* on the compass card, during the storm, together with its force, shows the ship to have been in the right center of the gale, as will appear also from a collation of the other reports. The duration of the gale and the slowness of the changes of its direction, with this ship, are largely due to her westerly progress, which in the later part coincided with the course of the storm.]

23. Brig *Florida Banca*, at noon of Sept. 2d, was in lat. 29° 30′, lon. 75° 54′; took the first of the gale about 10 P. M., wind N. E., veering afterwards to E., at which point it stood at noon of the 3d, about six miles south of the Hole in the Wall. Had the hardest of the gale between Stirrup Keys and the Banks in the afternoon and night of the 3d. (*Journal of Capt.* ELDRIDGE.)

24 *a*. Barque *Rapid*, WARD, bound for Havanna, Sept. 2d, A. M., wind E., five and six knot breeze; lat. obs. 26° 31′. P. M., wind N. E., begins fresh gales and clear weather. At 4 P. M. made the Hole in the Wall, S. W. by W., 15 miles. At 8 P. M. the Hole bore N. E. by E., 7 miles; ends with fresh gales and squally appearance.

Sept. 3d, at 1 A. M., made the Berry Islands bearing W. S. W., five miles, fresh gales and squally, took in main-top gallant sails. P. M., fresh gales and squally; at 2h. 30m. P. M., went off the Bank; wind N. E. by N.; at midnight made the Doubled-Headed Shot Keys and hauled up west.

Sept. 4th, at 2 A. M., the Double Shots bearing E. N. E. about nine miles distant, close reefed topsails and sent down fore-royal yard; at 5 A. M., finding the gale increasing sent down top gt. yards and took in flying-jib boom; reefed all sails and furled them as fast as possible; running before the wind under bare poles, wind N. N. E. At 8 A. M., still scudding, and judging the land of Cuba at not more than ten miles distance, brought the barque to under the main spencer. In less than ten minutes she was hove on her beam ends, the water rushed into the cabin, and every thing was soon washed from the deck. Finding no relief, cut away the mizen topmast to get her off before the wind, rather than founder. Lost the fore-topmast staysail, fore-topmast and head of the foremast, could not get the barque before the wind, and the sea constantly breaking heavily over her. By this time it was noon, and the wind, *which had suddenly shifted*, was blowing a tremendous hurricane from S. to S. W. At 1 P. M. the force of the hurricane began to abate, still blowing very heavy and in squalls. At 4 P. M. more moderate, and at 6 P. M. kept away S. W. under foresail, the wind at S. E. Sept. 5th, at daylight made the Pan of Matanzas. (*Logbook.*)

[It will be seen that the *Rapid* was further south while exposed to the gale, than either of the three vessels last mentioned. The sudden shift of the wind to an opposite direction shows that the barque was at that time near to the axis of the gale, and that this axis passed near to the north coast of Cuba in its westerly progress.]

24 *b*. Capt. WARD states that a Spanish ship was dismasted at Ginger Key, [lat. 22° 53′, lon. 78°,] the hurricane shifting "round the compass."

25. Barque *William Engs*, sailed from Key West, Sept. 3d, at 6 A. M., wind light from N. E. and fine clear weather; at noon sixteen miles S. S. E. from Key West light; barometer 30·10. At 6 P. M. the wind began to freshen, with dark clouds rising at N. and barometer fell rapidly till 8 P. M., when it stood at 29·70. Took in all light sails and put the ship under double reefed topsails; weather continuing to wear the same appearances.

Sept. 4th, at 2 A. M. took a heavy squall from N., which reduced us to close-reefed main topsail; barometer still at 29·70. The wind continued to blow with great violence from N. till 4 A. M., when it began to haul gradually to the eastward, which continued till 8 A. M., when it stood at E. S. E. and blew, if possible, with increased violence. We were now on soundings on the Florida Reef, and gaining nothing off shore, the sea breaking over us and preventing all communication with the cabin, so that the barometer could not be observed. At noon still blowing a hurricane from E. S. E. and continued steady at that point, with squalls of rain, till about 3 P. M., when it began gradually to subside, and at 10 P. M. had so far moderated that we could get up new sails from below and bend them; the wind continued to die away at E. S. E. till it fell calm. The barometer near the close of the gale stood at 30 inches. At noon of the 5th was in lat. 24° 15′, lon. 83° 35′. We judged our position at the commencement of the gale to be in lat. 24° 5′, lon. 81° 25′, making a drift of one hundred and eight miles to the west, which we could account for only by our being on soundings and having a strong counter current. We afterwards made Key West and found our chronometer correct.—(*Letter from Capt.* COE.) [This vessel was clearly in the right side of the gale.]

26. Capt. SMITH of ship *Christoval Colon*, states that on the 4th of Sept. a very heavy gale was experienced at Havanna and Matanzas, commencing at N. about sunrise, at Havanna, and veering westward round to S. S. W., and blowing with great violence for ten hours; causing much damage to the shipping in port. This is confirmed in substance by Capt. Boss of the barque Merchant, from Havanna, who states that by noon the gale had veered to N. W., increasing in force: and also by the statement of Lieut. MCCLURE, commanding H. M. S. Roman, furnished to Col. REID, from which we learn that in the afternoon the gale blew furiously from S. W., and continued from this quarter till 1 A. M. of the 5th, when the wind ceased, but heavy rain continued till 3 A. M.

27. Ship *Hilah*, from New Orleans for New York; Sept. 4th, 11 A. M., in sight of Havanna, a tremendous hurricane from N. W. At 5 P. M. gale increasing, saw the land about 300 yards to leeward; attempted to work the ship off, *when the wind suddenly shifted to S. W.* and blew still heavier. Cut away sails and rigging to save the spars.

28. Brig *Harriet*, in lat. 25° 1′, lon. 84° 9′, experienced a hurricane, lost spars, sails, &c.

29. Schr. *Emporium*, lat. 24°, lon. 84° 15′, in a severe hurricane, lost topmast, sails, &c., and sprung lower masts.

30. The barque *Euphrates*, from New Orleans for Marseilles, was dismasted on the 5th of Sept. in lon. 85° 30′.

31. Ship *Oconee*, from New Orleans, Sept. 5th, 6th, experienced a heavy gale, 100 to 150 miles S. E. of Balize, from N. E. by E. to E. by N., *with a heavy sea running from S. E.* Laid to *with head to S. E.* under close-reefed maintopsail for twenty four hours.—(*Statement of Capt.* JACKSON.)

32. Barque *Columbia*, from New Orleans, crossed the N. E. bar Sept. 1st, and had light winds from E. and E. S. E. till Sept. 4th, when the wind became fresh and squally from N. N. E., lat. 28° 8′, lon. 87° 28′. Sept. 5th, commenced blowing from N. E. with squalls and rain; lat 26° 49′, lon. 86° 51′, the gale increasing and veering to E. N. E. with a heavy sea. Sept. 6th, lat. 25° 31′, lon. 85° 30′; shortened sail to a three reefed maintopsail and main spenser; continued blowing a complete hurricane; from 6 to 10 P. M. expected every moment to see the masts go over the side. Sept. 7th the wind veered E. and abated; lat. 24° 35′, lon. 85° 2′: for two days after the hurrricane *had a very heavy sea from W. S. W.* which led us to expect a renewal of the gale from that quarter, the winds at the time being light from E. S. E. and E.—(*Statement of Capt.* TRUSSEL.)

We now pass to the left side of the storm.

33. The royal mail steamship *Solway*, left Vera Cruz for Havanna in the morning of Sept. 2d, and for the following two days had very fine weather. On the morning of the 5th a strong breeze commenced from E. N. E., (shifting afterwards to N., N. W., W., S. W. and S. E.,) which continued increasing all day, till at night it had amounted to a perfect hurricane ; the heaviest of which was from midnight till 4 A. M. of the 6th. The ship lost her sails, but behaved admirably, and during the height of the gale was laid to without steam. The barometer fell from about 30·10 to 29·28, and gradually rose again towards morning of the 6th. The gale subsided as rapidly as it came on, and the morning of the 7th was as fine and the sea as smooth as it had been two days previously. The position of the Solway at noon of the 4th was in lat. 22° 39′, lon. 89° 44′; noon of 5th, lat. 23° 30′, lon. 86° 50′; 6th not given.—[*Letter from Capt.* DUNCAN *to Gov.* REID.—Capt. D. informed Lieut. MCCLURE, commander of the *Roman*, that "he had never witnessed a more terrific breeze or heavy cross sea."]

34. The master of a Hamburg brig informed Capt. COE, of the *Wm. Engs*, that near Cape Antonio [west end of Cuba] the gale commenced at N. and veered by N. W. and W. to S. W.; and that his barometer here fell but 3-10ths of an inch.

35. H. M. S. *Rover*, KEELE, from Tampico for Bermuda; Sept. 5th, lat. at noon 23° 53′, lon. 93°, wind E. N. E., 4, cloudy, barometer 30·05. At 4 P. M. N. by E., 5, clouds and blue sky. Sept. 6th, at 5 A. M. wind N., ship steering E. by N.; the wind increasing and veering to the westward, with a heavy swell from N. W., strength of wind 8 [gale] with rain and ugly appearances, barometer falling. At noon, lat. 23° 49′, lon. 90° 27′, wind 9 [strong gale] with rain and a heavy sea; barometer 29·50. At 2 P. M. wind W. S. W., 10, [whole gale,] o. r. v. At 3 P. M. barometer 29·41, wind 11, o. r. u., with tremendous gusts, the surface sea greatly smoothed by the violence of the wind. I now considered the storm to be at its height, as the barometer began slowly to rise, still blowing hard till 5 P. M. It then gradually decreased and veered round to the S. W., S. S. W., and S., leaving a very heavy sea. At midnight, wind S., 7–9, rain; barometer 29·80. Sept. 7th, begins wind S., 7, o. g.; at 4 A. M. wind S., 6, o. p.; barometer 30; sea greatly abated. At noon, lat. observed 24° 2′, lon. 88° 21′, wind S. E., 5, c. g. Current since noon of the 6th, S. 35° W., 24 miles.—(*Logbook.*)

Our next report is from the right side of the storm.

36. The sloop *Dream*, from Texas for New Orleans, was sunk during the gale, on the 7th of Sept., off Raccoon Point, near lat. 28°, lon. 91°.

Having thus followed the storm over the Bahamas and the Mexican sea, we come now to the reports of its appearance in the northern provinces of Mexico, as found in the Bermuda Royal Gazette.

37. The hurricane reached the town of Victoria,* situated below the table land of Mexico, in lat. 23° 28′, lon. 102°, at 6 A. M., Sept. 8th, 1842. The wind set in at *north*, and increased in violence, from the same quarter, until 1 P. M. It then fell a *profound calm* for five or six minutes, when immediately afterwards the wind came from the *south* with renewed fury. Victoria is a town containing about 4000 inhabitants. Between two and three hundred houses were blown down. Oaks and other stately forest trees were uprooted, and some of them transported 50 or 60 yards. At Victoria the storm set in with heavy rain.—This account is from the Russian Baron KARWINSKY, travelling for his government in Mexico.

38. "At Soto de la Marina, [lat. 23° 42′, lon. 98° 10′,] within 7 or 8 miles of the sea coast, the wind blew as it did at Victoria. Baron KARWINSKY made every inquiry in order to trace its progress in Mexico. He found it proceeded westward but only 60 miles [from Victoria] and there he supposes it to have ceased, and at that distance it must have encountered the high table land.

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* La Ciudad de Victoria, or Durango.

39. Mr. Stewart Jolly, the British Consul at Tampico, to whom we are indebted for Baron Karwinsky's report, states that at Tampico, during the time when the storm was passing so near there to the north, "it was a dead calm and the air insufferably hot and oppressive."

From the observations above recited, we may derive the deductions and remarks which follow.

Daily Progression of the Storm.

If we take the storm date of the *Antje* as noon of August 30th, we find the rate of the storm's progress from thence to Victoria to have been four and one third degrees of longitude per day; but if this date be for the afternoon of 30th in *sea reckoning*, 29th in civil time, then the rate is about four degrees per day.* From the meridian of Havanna, lon. 82° 20′, to the place of the *Rover* at 2 P. M. of Sept. 6th, near lon. 90° 27′, the storm was about two days in its progress, which also shows an advance of four degrees per day.

This rate of progression would bring the storm to Soto de la Marina, in lon. 98° 10′, on the 8th of Sept., which is the date given above for its appearance at Victoria in lon. 102°, where it should arrive on the 9th, according to the above rate of advance. Still there can be little or no doubt that the storm of both Soto de la Marina and Victoria was identical with that which was passing through the Gulf of Mexico on the 5th, 6th, and 7th; and we must leave it to Mr. Jolly or the Baron Karwinsky to reconcile or explain the dates, as they appear in the Bermuda Gazette.

Course of the Storm and Route of its Vertical Axis.

The course pursued by this storm, as deduced from the foregoing reports, was nearly due west; and the route of its vertical axis, at least from the Bahamas, must have been between 23° 30′ and 24° north lat.; being nearly parallel and coincident with the tropic of Cancer. The axis appears to have been nearer to the tropic when off the point of Florida and in Mexico, than when off the Campeche Bank in lon. 90°.

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* The daily sea reckoning is made up at noon, commencing from noon of the preceding day; and the absurd custom still prevails of affixing to the afternoon, or first twelve hours of the reckoning, the date of the succeeding day. This useless and perplexing practice has, for many years, been excluded from the English navy, but I am sorry to find that it is still continued in our own naval service. Many intelligent masters in our merchant service have abandoned it. To attain fully this desirable end nothing more is necessary than to affix their true dates to each of the twelve-hour tables of the logbook.

In this article, to avoid confusion of dates, care has been taken to reduce the several nautical dates to civil time, in all cases where it has been practicable.

On the north coast of Cuba we find two vessels, the ***Rapid*** and ***Hilah***, which had the first part of the gale from the northward and then shifting suddenly to the southern quarter and blowing with like violence, which shows them to have been near the line pursued by the axis of the gale. At Soto de la Marina on the coast of Mexico and at Victoria in the interior, we find the gale blowing first from the north, then a short *lull*, such as appears to mark the axis in all great hurricanes, and then the recurrence of the blast in full violence from the south as the gale advanced; which fixes the course of the axis at or near these points, and shows, also, the rotative character of the gale.*

It is well to bear in mind the direction of these successive winds, as not being first from the west and then from the east, parallel to the route of the storm, but on the contrary, *crossing*, in succession the path of its axis.

Hourly Progress, and Prolonged Duration with Vessels moving Westward.

We have seen that the rate of progression in this hurricane was about four degrees of longitude per day; which, if we estimate the degree on the parallel pursued by its axis at 63·2237 statute miles, shows an advance but little exceeding ten and a half miles per hour. This will fully account for the increased duration of the gale with those vessels which were running or drifting westward while exposed to its violence.—See cases 22 *b*, 24 *a*, 25, and 32.

Vorticular Character of the Gale.

The continuance of violent easterly winds in this gale on the northern side of its axis, the simultaneous presence of violent and accordant winds from northern points of the horizon in the front side of the gale, the westward veering of the northwesterly winds on the southern side of the storm's axis, and the further sweeping of the winds across the center path of the storm, in the rear side of the gale, from southern points of the horizon,—all go to sustain the conclusion that it was one vast whirlwind, blowing around a vortical axis, which advanced with the storm.†

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* This unfailing "*experimentum crucis*" of the character of storms appears to have been sufficiently obvious from the time of the first inquiries on their rotatory action.

† Had the violent winds which were exhibited in the front portion of this gale been found blowing from the west, in the more central portions of its path, and had the later

Strength and Extension of the Trade or Northeasterly Wind on the Northern Side of the Storm.

It has been seen that along an extensive portion of its path and on its northern side, this storm was preceded and attended by a strong northeasterly wind, which appears to have coincided with the right front of the stormy vortex and to have extended as far northward as the Carolinas. This coincident wind, pressing upon the northern border and right front of the hurricane, may have contributed to the vortica extent and activity of this portion of the storm, and doubtless had no small influence in producing its unusually western course.

Eccentrical Position of the Vortical Axis in the Storm.

The greater extent of the gale on the right or northern side of its axis of revolution, or axis route, as compared with its extent on the left side of the axis line, constitutes a remarkable feature in this storm. One probable, if not principal cause of this unequal extension has just been noticed.

This extension of the sensible effects of the storm on the right of its axis path, conforms very strikingly to the effects which have been observed in the paths of small and destructive whirlwinds or tornadoes. This is shown in the case of the tornado which visited New Brunswick, N. J., in June, 1835,* and in that which passed near Providence, R. I., in August, 1838;† and these agree with other observed cases which have not been published. This characteristic has pertained, likewise, to other great storms; owing, probably, to causes which differ somewhat from those which produce the like effect in smaller whirlwinds. But this peculiarity in great storms appears not so common and so strongly marked as in the tornadoes.

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winds of the storm blown along the path of its axis from the east and with still greater force, or had two set of winds, from opposite sides of a central or axial east and west line, blown severally and simultaneously towards that line or some point on the same, in direct opposition to each other, and each set been found limited to its own side of the axis line, instead of blowing *in succession across extensive portions of the same path*, then might it have been claimed that the winds from all sides of the storm blew towards a central point or line, in the body of the storm. But the facts which have been observed appear to forbid such a supposition; not only as relates to this storm, but also as regards every other American tempest which has been duly examined.

* See this Journal for 1841, Vol. XLI, pp. 73, 79, with diagram of survey.

† This Journal for 1842, Vol. XLII, pp. 269 to 278.

Absence of a Brisk Trade Wind on the Southern Margin of the Storm.

We may infer from the reports of the Brig *Rolla* and H. M. Ships *Pilot* and *Ringdove*, that calms and light winds prevailed in the Caribbean Sea and on the southern margin of the storm during the observed progress of the latter. The usual prevailing course or tendency of the lower currents of air, in these regions, at least in the hurricane months, *appears to be from a point south of east*, instead of north of east, as is often supposed.* This general tendency towards some point which is north of west must usually control the courses of the storms in this region. But the lightness of the surface winds of the Caribbean Sea at this period,

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* I have ascertained, long since, from logbooks, published journals and nautical directories, that the course of the trade-winds, at their inferior surface, is often parallel to and even one point or more *from* the equator; particularly inside the tropics. From the reported courses of the lower clouds and squalls, by intelligent voyagers and residents in the West Indies, I have also learned, that the course of the lower cloud currents is often, if not generally from southeastward, at least during the northern summer: while the observed courses of the West India hurricanes has demonstrated the northwesterly tendency or courses of of the lower currents, viewed as a whole, in these regions.

Mr. Lawson, in Jameson's Edinburgh Phil. Journal, for July, 1845, has given the results of his observations both on the surface winds and cloud currents at Barbadoes, lat. 13° 10′ N., in 1841; from which it appears that from May to September inclusive, the observations on the surface winds, made at regular periods, have resulted, numerically, as follows: viz. N. W. winds, 3; N., 2; N. N. E., 4; N. E., 13; E. N. E., 106; E., 122; E. S. E., 66; S. E., 41; S. S. E., 13; S., 1; S. W., 2: the E. N. E. being the most frequent wind north of east, while the S. E. and S. S. E. winds greatly predominate over those from N. E. and N. N. E.

His observations on the cloud currents are still more interesting and important. Complete tables of these are given for September and October, which may be taken for nearly average months, as between summer and winter. Two or more currents commonly appeared, above the surface wind; a lower current from south of east and a higher one from S. W.; *both* of which, as well as all *cloud currents* in non-mountainous regions, should be viewed as pertaining solely to the lower atmosphere. The numerical results for the two months were as follows: viz.

Abstract of Observations of the Surface Winds and Cloud Currents at Barbadoes, in September and October, 1841. (Observations taken at 5 A. M.; 10 A. M.; 3 P. M., and 9 P. M.)

From what direction.	Winds.	Cloud currents.	Totals.	From what direction.	Winds.	Cloud currents.	Totals.
W. N. W.		1	1	E. S. E.	21	8	29
N. W.		5	5	S. E.	29	26	55
N. N. W.	1	16	17	S. S. E.	4	31	35
N.	1	18	19	S.	3	11	14
N. N. E.	5	4	9	S. S. W.	1	6	7
N. E.	12	9	21	S. W.		89	89
E. N. E.	90	16	106	W. S. W.	1	6	7
Northeasterly & northerly obs.	109	69	178	*Southeasterly & southerly obs.*	59	177	236
East obs.	30	15	45				

These, with a vast extension of similar phenomena, merit the serious attention of those naturalists who rest on the calorific theory of the general and trade winds; and they seem fully to account for the northwesterly courses of storms in the West Indies.

when viewed in connection with the strong trade or northeasterly wind which we have noticed as then existing in more northern parallels of latitude, may be deemed sufficient to account for the unusual west course of this hurricane.

The hurricane of August and September, 1842, which has now been considered, caused great injury to commerce and the total loss of many vessels with their crews.

What is meant by Rotary or Vortical Action in Storms.

When in 1830 I first attempted to establish by direct evidence the rotative character of gales or tempests, I had only to encounter the then prevailing idea of a general rectilinear movement in these winds. Hence I have deemed it sufficient to describe the rotation in general terms, not doubting that on different sides of a rotary storm, as in common rains or sluggish storms, might be found any course of wind, from the rotative to the rectilinear, together with varying conditions as regards clouds and rain.

But I have never been able to conceive, that the wind in violent storms moves only in *circles*. On the contrary, a vortical movement, approaching to that which may be seen in all lesser vortices, aerial or aqueous, appears to be an essential element of their violent and long continued action, of their increased energy towards the center or axis, and of the accompanying rain. In conformity with this view, the storm figure on my chart of the storm of 1830* was directed to be engraved in spiral or involute lines, but this point was yielded for the convenience of the engraver. Some indication of the character of a great vortical movement is found in the arrows of the storm figures on my chart of 1835, on tracks I, V, and VII.† In Vol. xxxv, pp. 203–205, of this Journal, and Vol. xlii, p. 114, I have noticed, cursorily, the variable as well as vortical conditions which pertain to great storms. Some of the effects of vortical rotation are also discussed in my account of the Providence tornado.‡

The common idea of rotation in circles, however, is sufficiently correct for practical purposes and for the construction of diagrams, whether for the use of mariners or for determining between a general rectilinear wind, on one hand, or the lately alleged centripetal winds, on the other. The *degree* of vorticular inclination in violent storms must be subject, locally, to great variations; but it is not probable that, on an average of the different sides, it ever comes near to forty five degrees from the tangent of a circle,—and that such average inclination ever exceeds two points of the compass, may well be doubted.

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* This Journal, Vol. xx. The dotted part of this figure was intended to indicate the area of rain.

† See also the storm figures in this Journal, Vol. xxxi, p. 117, and Vol. xxxv, p. 214.

‡ Vol. xliii, p. 271—275.

Second Hurricane of September, 1842.

Between the 18th and 22d of September another storm of violent character crossed the Gulf of Mexico, probably in a northeasterly direction and at a slow rate of progress; but I have not sufficient means for tracing its further advance with much accuracy. This storm also occasioned much injury to the vessels which were exposed to its violence.

Rate of Progression in Storms observed only in the Tropical and Lower Latitudes.

In the following table I have presented some of the principal facts relating to the progress of four several storms of the American seas, the courses of which have been observed only in the lower latitudes. I have also added to this table a storm of the Bengal Sea and Indian Ocean, described by Mr. Piddington in his Eighth Memoir on the Law of Storms in India. This storm is also distinguished as having moved nearly to the west, but in much lower latitudes than the *Antje's* hurricane.

No. of the track on Chart I.	Date of Storm.	Approximate course of the storm.	Approximate latitude of known route.	Direction of the vorticular rotation in the storm.	Length of known route, in statute miles.	Average rate of advance per hour.
I.	June 23d—27th, 1831.	N. 74° W.	14° 30′ N.	Right to Left.	1900 miles.	18·5 miles.
II.	Aug. 10th—17th, 1831.	N. 64° W.	20° 30′ N.	" "	2160 "	14·4 "
V.	Aug. 12th—18th, 1835.	N. 73° W.	21° 45′ N.	" "	2430 "	16·5 "
XII.	Aug. 30th—Sept. 9th, 1842.	W.	23° 45′ N.	" "	2650 "	10·5 "
	Oct. 22d—Nov. 1st, 1842.	W.	12° N.	" "	2100 "	9 "

The average progression of the four American storms of this table somewhat exceeds fifteen miles an hour. It will be seen that the East Indian storm advanced only at the rate of nine miles per hour, which is one of the slowest rates yet observed, and is much below the average rate of progression of storms in the Asiatic seas.* Perhaps the tardy progression in this case was owing to the proximity of the storm to the equatorial region and to a sluggish state of the aerial currents then prevailing on its track.

These five storms may be viewed as belonging to one group in the great system of storm paths; a system which appears to me as resulting *directly* from the dynamical influence of the diurnal and orbital revolutions of our planet.

Gales distinguished as Northers, in the Seas of Mexico and Central America.

The term *Northers* may well be applied locally to such storms as the first four comprised in the above table, which passed westwardly through the Mexican sea; for their vorticular rotation being in the direction from right to left, thus, ↺, they necessarily, on arriving near the coast, commenced to blow from some northern point of the horizon.

But the term is most frequently and technically applied to the numerous gales which visit the seas of Mexico and Central America from September to April, and which are almost unknown among the islands of the Antilles or West Indies. Two of these Northers, of much interest, will next claim our attention.

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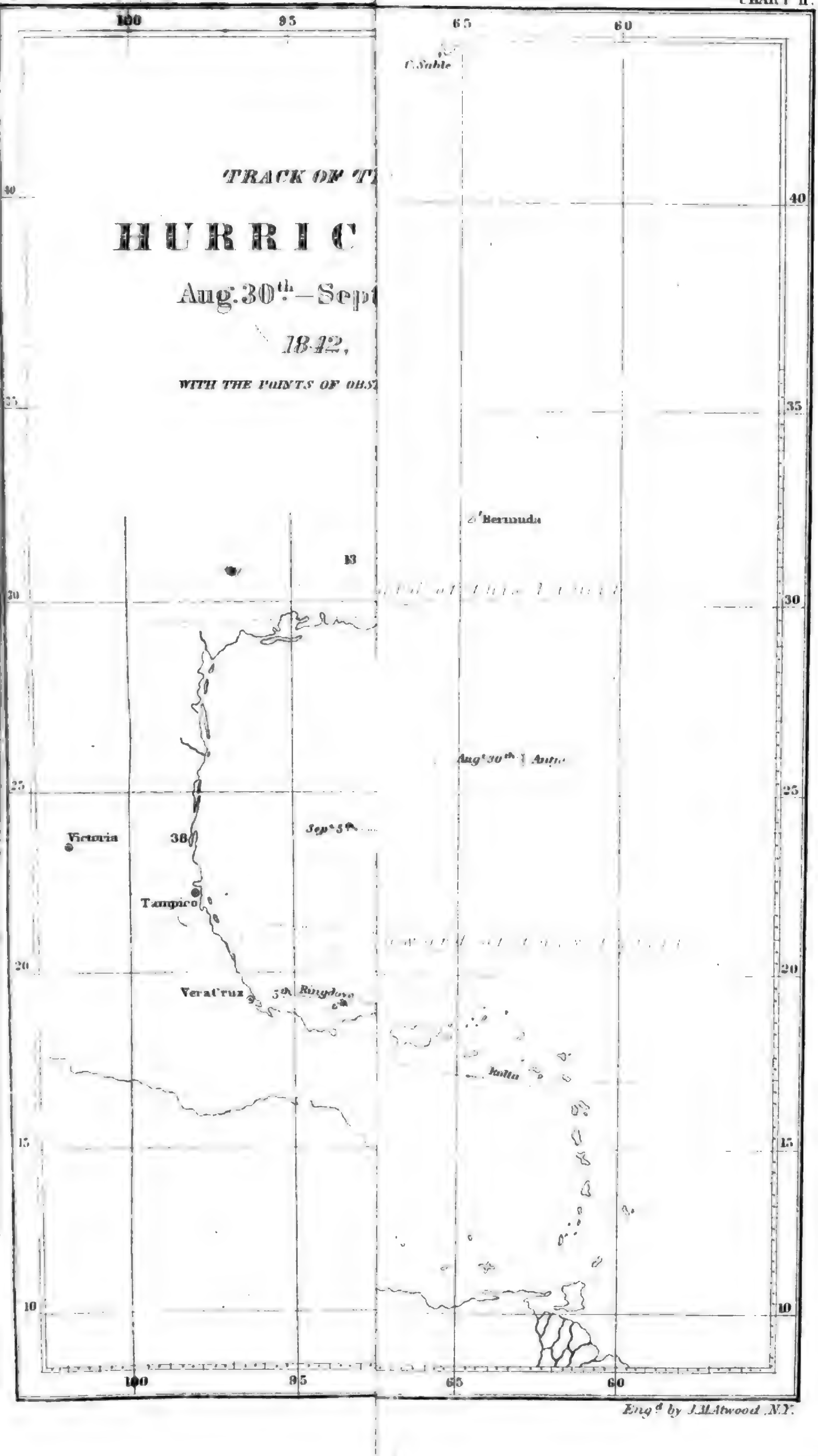
* Mr. THOM computes the diurnal progression of the Rodriguez hurricane of April, 1843, in the South Indian Ocean, at about 220 or 230 miles, or between nine and ten miles an hour, during its early stages in the lower latitudes; and that it gradually diminished till, when near the tropic, it scarcely exceeded fifty miles per day.

Mr. THOM appears to think that the hurricanes of that region probably break up and disappear near the southern margin of the southeast trade wind. This view I cannot reconcile with previous observations in the two hemispheres. A wider scope of observation than was had in the Rodriguez storm would probably show that these hurricanes turn eastward in their course, after crossing the tropic, and that they are identical with some of the violent gales which China ships fall in with while running eastward in the Southern Ocean, between 36° and 40° of south latitude.

The Rodriguez hurricane may have commenced its *easterly* course soon after crossing the tropic; and its slow rate in this region I ascribe, chiefly, if not wholly, to the gradual cessation of its westerly progression.

I apprehend that to a like change in the winds from a westerly to an easterly progression, and *vice versa*, is also to be ascribed, mainly, the several parallel belts of calms and variables which are found on the exterior borders of the trade winds, between the trades and the monsoon winds, and on the equator. Such a system of changes in the great winds of the globe, in the regions referred to, I deem may be fully established by a proper analysis of existing authorities and observations.

CHART II.



Engd by J.M.Atwood N.Y.

Art. II.—*Contributions toward a History of Entomology in the United States;* by John G. Morris, D. D., Baltimore.

(Read before the National Institute, April meeting, 1844.)

Entomology is of all branches of natural history the least cultivated by scientific gentlemen in our country. In Europe, especially on the continent, no department of zoology is more industriously pursued, and none has called forth more numerous or more splendid illustrated works. The science is taught in the gymnasia and universities, collections of insects systematically arranged are found in most of the literary institutions, and are properly considered an essential part of a museum of natural history.

In our own country, the subject has been totally neglected, except by a few, but they have accomplished much, and have rendered invaluable service to the science. They have smoothed the path for their successors, who, it is hoped, will diligently walk in it.

The reasons for this neglect of the science in our country, may be found in the presumed greater economical importance of other branches of natural history; in the diminutive size of insects, often requiring microscopic observation to determine their generic and specific character; in the unfounded apprehension of their poisonous qualities, so common even among educated persons, many of whom have a horror of every thing called a *bug;* in the fatigue and exposure endured in their capture; in the want of entomological books; and in the morbid sensitiveness on the subject of impaling them on a pin. But all these objections vanish on the slightest acquaintance with the subject; and it is presumed that no one ever began the study of it, who was not allured by its powerful attractions to prosecute it to some extent. The field is still very inviting in this country, for thousands of species still remain undescribed—in every excursion the industrious collector captures something new.

Other departments of natural history have been so thoroughly explored as to leave little room for new discoveries or improvements. A new North American bird would be literally a "*rara avis;*" a new mammal would be deemed extraordinary; and a new fresh-water fish would verily be a *queer* one. Indeed, it may well be a ground of exultation that our naturalists have done so much to illustrate the Fauna of our country. The works of some of them exceed in magnificence and pictorial execution those of any other country, and the literary portions will compare with the most finished scientific compositions of the world. Our mammals have in part been described and figured by GODMAN, HARLAN, BACHMAN, DEKAY, SAY, and ORD, and another splendid work on this order is in preparation by AUDUBON and BACHMAN. Our birds have been represented almost to the life by WILSON, BONAPARTE, AUDUBON, ORD, NUTTALL, BACHMAN, TOWNSEND, and the two BAIRDS. Our reptiles have been described and figured by GREEN, LECONTE, SAY, HARLAN, LESUEUR, and HOLBROOK; our fishes by MITCHILL, LESUEUR, STORER, DEKAY, SMITH, RAFINESQUE, KIRTLAND, AYRES, and HALDEMAN; our shells by SAY, RAFINESQUE, CONRAD, LEA, GOULD, BINNEY, HILDRETH, BARNES, HALDEMAN, ADAMS, and MIGHLES; our crustacea by SAY, GOULD, and HALDEMAN, (the fresh-water microscopian species, especially by the latter.) All these orders have been industriously studied, and he who desires to pursue them still further, has been furnished with books by these accomplished naturalists that will be indispensable.

Entomology has had the fewest cultivators, but still, as was before observed, much has been done. It is my design to give a brief history of the science in the United States, as far as the facts could be ascertained.

The father of American entomology is the Rev. F. V. MELSHEIMER, a Lutheran clergyman who resided in Hanover, York Co., Pa. He was a German by birth, and came to this country in 1777 as chaplain to the Brunswick troops. He was taken prisoner by the Americans at the defeat of Burgoyne, and like many of his countrymen in that expedition, he preferred remaining in the land of his captors to returning to Europe. After performing ministerial functions in several towns of Pennsylvania, he removed to Hanover, where he commenced his entomological pursuits, more than fifty years ago. Some of his first collections are still in the possession of his son. He soon after began an entomological correspondence and exchange with his countryman, Prof. KNOCH of Brunswick, which continued without interruption to within a year of his death in 1810. He published no entomological work except his celebrated catalogue of the

Coleoptera of Pennsylvania, which is quoted as authority by every writer on our insects. His manuscripts are numerous, the principal of which is a definition of the species enumerated in the catalogue, and of about six hundred other species not noticed in it. He wrote a work on mineralogy and a journal of a tour in Pennsylvania, which were published in Germany, besides several books on controversial divinity which were printed in this country. At his death, his collection and manuscripts passed into the hands of his son, the Rev. JOHN MELSHEIMER, who also succeeded to the pastoral care of his father's church. This is the gentleman so frequently mentioned by SAY in his writings. He contributed considerably to the promotion of the science by adding many new species to the collection, and furnishing SAY with such as he wanted, and his observations on them. At his death in 1829, the original collection, the books and manuscripts of father and son, became the property of another son, Dr. F. E. MELSHEIMER, now residing near Dover, York Co., Pa. This gentleman is a most industrious prosecutor of the science, and must be considered one of the best entomologists of the country. His nice discrimination and laborious research have shed much light on the subject; he has cleared away many difficulties—he has discovered the habits of many known, and determined the specific character of many unknown species. He has described more than six hundred new species of *Coleoptera*, which are now in the course of publication in the Proceedings of the Academy of Natural Sciences at Philadelphia. His manuscripts on our *Lepidoptera*, particularly the *Noctuidæ*, are voluminous, which it is hoped will also be eventually published.

The late Prof. WM. D. PECK of Cambridge, Mass., was perhaps the next person after the elder MELSHEIMER, who paid any considerable attention to the subject. He described various species which are injurious to vegetation, in "The Massachusetts Agricultural Repository and Journal." He seemed to confine his attention chiefly to the economical department of the science. His writings contributed much to enlighten agriculturists on this branch of their profession; for their forest and fruit trees, their garden vegetables, grains and other products, are often subject to the ravages of insects whose nature and habits they do not know, and of course, they are ignorant of the best methods of destroying them. As far as could be ascertained, the following are the titles of his papers. 1. Natural history of the slug worm, (*Blennocampa Cerasi.*) Bost. 1799. 8vo, pp. 14, with a plate. 2. A history of the pine weevil, (*Rhynchænus Strobi,*) with a figure of the insect. 3. A history of the pear tree *Scolytus*, (*S. Pyri,*) with a figure. 4. A history of the oak pruner, (*Elaphidion putator,*) with a plate. 5. The natural history of the canker worm, (*Phalæna* (*anisopteryx*) *vernata,*) the larva of a moth, which in New England is injurious to the apple and elm trees.* 6. A description of the Cossus of the locust tree, (*Cossus Robiniæ.*) This gentleman may have written other papers, but they are unknown to me. They were published in agricultural journals which had not a wide circulation out of New England, and difficult, perhaps impossible, to be procured at the present time.

The first illustrated work on American insects that ever appeared, is *The Natural History of the rarer Lepidopterous Insects of Georgia, collected from the drawings and observations of* Mr. JOHN ABBOT. This splendid work appeared in London in 1797, in two large folios, and was edited by Sir JAMES E. SMITH. There are but few copies in this country, one of which is in the library of Congress. It contains figures and short descriptions of one hundred and three of our Lepidopterous insects. SWAINSON pronounces it "to be one of the most beautiful and most valuable illustrated publications that England or any other country can boast of. The plates are the last and best of MOSES HARRIS's performances." ABBOT sent many other figures of the same order of insects to London, but they have never been published.

CATESBY's great work on the natural history of Carolina, Florida, and the Bahama Isles, appeared some years before ABBOT's, but as a small portion of it only is devoted to entomology, it scarcely belongs to our department. There are but twenty four insects figured and described in the two immense folios.

The next laborer in this inviting and interesting field, is the celebrated SAY. He has acquired an undying fame by his indefatigable industry and enthusiastic devotion to this pursuit—by his extensive travels in our country in its prosecution—by his numerous writings and his extensive correspondence with foreign entomologists. Various scientific journals of our country are enriched with his papers on this and various other branches of natural history. He furnished fifty four contributions for the journals, besides three 8vo volumes on entomology exclusively. Besides insects, he described numerous fresh-water, marine, and land shells, crustacea, arachnides, reptiles, several species of mammals, radiata, zoophytes, annulosa, myriopoda, and entozoa. He wrote also a valuable paper on fossil geology, but his principal and favorite study was entomology. He described eleven hundred and fifty *Coleoptera*, two hundred and twenty five *Diptera*, one hundred *Hemiptera*, and one hundred species of other orders. He established several new genera, made many valuable observations on those already recognized, and numerous interesting and curious remarks on the habits and transformations of insects.

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* The larva which commits such ravages on the foliage of the elm in the South is not the canker worm of Prof. PECK. It is the larva of a beetle unknown in New England, (*Galeruca Calmariensis,*) and identical with that of Europe, whence it has been imported.

It is to be regretted that his papers are scattered through a variety of publications, from the Transactions of the American Philosophical Society, through KEATING'S Narrative of LONG'S Expedition, down to a village newspaper, so that it is impossible for the student to procure them all, and some of them are irrecoverably lost. A proposal was issued by M. GORY of Paris, a few years ago, to collect them all and translate them into French, but it is believed the work was suspended after the publication of four thin *livraisons*.

I have thought it well to give the titles of his papers on insects and the work in which they are published. It may be of benefit to those who desire to consult them or possibly to collect them.

1. Description of several new species of North American insects.—Jour. Acad. Nat. Sciences, Phila., Vol. I, p. 19, 1817.

2. Some account of the insect known by the name of the Hessian fly, and of a parasite insect that feeds on it.—Jour. Acad., Vol. I, p. 45.

3. Monograph of the North American insects of the genus *Cicindela.*—Amer. Phil. Soc. Trans., New Series, Vol. I, p. 401, 1818.

4. Description of the *Thysanoura* of the United States.—Jour. Acad., Vol. II, p. 11, 1821.

5. On the South American species of *Oestrus*, which infests the human body.—Jour. Acad., Vol. II. p. 353, 1822.

6. Descriptions of insects of the families *Carabici* and *Hydrocanthari* inhabiting North America.—Am. Phil. Soc. Trans., New Series, Vol. II, p. 1.

7. Descriptions of some new species of *Hymenopterous* insects, collected during the expedition to the Rocky Mountains, under the command of Maj. Long in 1819–20.—Western Quarterly Reporter, Vol. II, No. 1.

8. Descriptions of insects belonging to the order *Neuroptera*, collected by the expedition under the command of Maj. Long.—Western Quarterly Reporter, Vol. II, p. 160.

9. Descriptions of *Dipterous* insects of the United States.—Jour. Acad., Vol. III, p. 9, 1823.

10. Descriptions of *Coleopterous* insects collected in the expedition to the Rocky Mountains.—Jour. Acad., Vol. III, p. 139, Vol. IV, p. 83.

11. Account of the insect (*Ægeria exitiosa*) so injurious to the peach tree.—Jour. Acad., Vol. III, p. 216, 1823.

12. The appendix to Keating's narrative of an expedition to the source of St. Peter's river, contains descriptions of insects by Say, Vol. II, 1824, 8vo, Phil.

13. American Entomology. 3 vols. royal 8vo, 1817–28.

14. Descriptions of new American species of the genera *Buprestis*, *Trachys*, and *Elater*.—Annals of the Lyceum of New York, Vol. I, p. 249, 1825.

15. Descriptions of new *Hemipterous* (and *Orthopterous*) insects, collected in the expedition to the Rocky Mountains.—Jour. Acad., Vol. IV, p. 307.

16. Descriptions of new species of *Hister* and *Hololepta* inhabiting the United States.—Jour. Acad., Vol. V, p. 32, 1825.

17. Descriptions of new species of *Coleopterous* insects inhabiting the United States.—Jour. Acad., Vol. V, p. 160, 1825–6.

18. Note on Leconte's *Coleopterous* insects of North America.

19. Descriptions of new species of *Hymenoptera* of the United States.—Two papers published in a periodical entitled "Contributions to the Maclurean Lyceum of Philadelphia," 1827–28.

20. Descriptions of North American *Dipterous* insects.—Jour. Acad., Vol. VI., part 1., p. 149, Vol. VI, part 2, p. 183, 1829–30.

21. Correspondence relative to the insect that destroys the cotton plant.—New Harmony Disseminator, 1830.

22. Descriptions of North American insects, and observations on some already described.

This paper was printed at New Harmony, forming an 8vo volume of 81 pages. Part of it was reprinted in Amer. Phil. Soc. Trans., Vol. IV, New Series.

23. Descriptions of new species of *Curculionites* of North America, with observations on some of the species already known. 8vo, pp. 30. New Harmony, Indiana, 1831.

24. Descriptions of new species of the *Heteropterous Hemiptera* of the United States.—8vo, pp. 39. New Harmony, 1831.

25. New species of North American insects, found by JOSEPH BARABINO, chiefly in Louisiana.—8vo, pp. 16. New Harmony, 1832.

26. Descriptions of new North American *Hemipterous* insects, belonging to the first family of the section *Homoptera* of LATREILLE.—Jour. Acad., Vol. VI, p. 235, 1830–31.

27. Descriptions of new North American *Coleopterous* insects, with observations on some already described.—Boston Jour. of Nat. Hist., Vol. I, p. 2, 1835.

28. Descriptions of new species of North American *Hymenoptera* and observations on some already described.—Boston Jour. Nat. Hist., Vol. I, No. 3, 1836, No. 4, 1837.

29. Descriptions of new North American *Neuropterous* insects and observations on others already described.*

SAY's most costly, though not most valuable work, is the American Entomology, in three fine 8vo volumes. It contains the figures and descriptions of one hundred and thirty two insects of various orders, but unhappily, more regard seems to have been paid to the typographical beauty and external decoration of the work than was necessary, for its consequent high price prevented its general circulation.

SAY died in the full vigor of manhood, (aged 46.) If his valuable life had been spared a few years longer, our science would have reached a lofty eminence through his untiring zeal and persevering energy.

He was one of the original founders of that distinguished institution, the Academy of Natural Sciences of Philadelphia, and for thirteen years was one of its most industrious members and voluminous contributors to its invaluable journal. He rendered distinguished service to the Academy in every respect, but especially in the commencement, in describing, classifying, arranging, and cataloguing its collections. The institution, in fact, was in a great degree the work of his hands.

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* For this list of SAY's entomological writings I am indebted to the Magazine of Natural History, New Series, Vol. III, p. 139, (London,) to which it was contributed by Mr. DOUBLEDAY.

Maj. LECONTE's labors in this field properly belong to this period. This eminent naturalist has never published much on the subject, but his services have been invaluable. There is one paper from his pen, describing some southern Coleoptera, in the Annals of the New York Lyceum of 1824, and a monograph of the family *Histeridæ* with outline figures, in the Boston Academy's Journal of 1845. He contributed largely to that splendid foreign work, BOISDUVAL et LECONTE *Histoire Generale des Lépidoptères de l'Amerique septentrionale*, and I presume furnished most of the specimens and drawings with observations on the larvæ and their transformations. His son, JOHN LECONTE, Jr., is an industrious young entomologist, who bids fair to become eminent in the science.

The entomologist next claiming our attention in the order of time is Dr. THADDEUS W. HARRIS of Harvard University. For many years he has contributed much to the advancement of the science by his valuable papers in the journals. His published writings, as far as they have fallen under my notice, are: 1. A catalogue of the insects of Massachusetts, appended to Prof. HITCHCOCK's Report on the Geology of that state, 1835. 2. A description of some Coleopterous insects, in the Transactions of the Natural History Society of Hartford. 3. A prize essay on the noxious insects of the genus *Melolontha*, in the Massachusetts Agricultural Repository and Journal, Vol. X, 1826. 4. A discourse before the Massachusetts Horticultural Society, 1832. 5. A paper on the genus *Hispa*, in the Journal of the Boston Nat. Hist. Soc. 6. Description of *Tettigonia vitis*, in the Encyclopedia Americana, Vol. VIII. 7. The article *Locusta* in the same work. 8. Descriptions of *Coccus*, (bark louse,) in the New England Farmer, 1828. 9. Description of *Pontia oleracea*, Ibid., 1829. 10. A descriptive catalogue of American *Sphingidæ*, Silliman's Journal, Vol. XXXVI. 11. History of *Ægeria exitiosa*, an insect destructive to peach trees.—New England Farmer, Vol. V. 12. Description of *Ægeria Pyri*, Ibid., Vol. XII. 13. Description of *Arctia pseuderminea*, (salt-marsh caterpillar and butterfly,) 1823. 14. Description of *Sirex Columba*, New England Farmer, 1827. 15. Observations on the insects in the barley straw, Ibid., 1830. 16. Observations on wheat insects, Ibid.,

1831. 17. Remarks on *Scarabæus Goliathus* and other African insects allied to it. 18. A paper on the genera *Cremastocheilus*, in Jour. Acad., Phila.

But the most important work of Dr. Harris is a treatise on some of the insects of New England which are injurious to vegetation. It is an octavo volume of 459 pages, (Boston, 1841,) and conveys invaluable information to the agriculturist on a subject very little understood among that respectable portion of the community. The beginner in entomology may also derive much important assistance from it. The enlightened state of Massachusetts, I believe, took the lead of other states in appropriating funds for a complete zoological survey of her territory, and this work of Dr. Harris's is one of its invaluable fruits. It is to be regretted, however, that it is not illustrated by figures. This would have rendered it much more valuable to the farmer and horticulturist, who, if unacquainted with entomology, do not easily recognize an insect from a bare description, however accurate. The work treats of the insects most injurious to vegetation, and displays most diligent observation and industrious research.

Various other papers on insects have appeared in the journals; several by Prof. Hentz in the Transactions of the American Philosophical Society and in the Boston Journal; by Dr. Gould and Mr. Randall in the same publication; by Dr. Melsheimer in the Journal of the Academy, Phila.; by Rev. Mr. Ziegler of York, Pa., and young Leconte, in the same; by Prof. Haldeman, so favorably known by his splendid work on the fresh-water univalve mollusca of our country, and his "Zoological Contributions." This gentleman has completed a full monograph of the family *Longicornia*, which will be published this year in the Trans. of the Am. Phil. Soc. Prof. Potter, late of Baltimore, published a pamphlet on the *Cicada septendecim*, most of the observations of which were furnished by Dr. Gideon B. Smith, of the same city. This gentleman is extending his observations on that remarkable insect, and has collected a large number of interesting facts, especially in relation to its periodical appearance in different sections of the country. Mr. A. Halsey of New York also published several papers in the journals. An attempt was made some years ago, by Mr. Titian R. Peale of Philadelphia, to publish an illustrated work on our *Lepidoptera*. Several numbers were issued, but the laudable enterprise failed for want of support.

Kirby, in the Fauna Boreali-Americana, has described and figured a considerable number of our insects. The older writers of Europe, **Linne**, **Fabricius**, **Herbst**, **Cramer**, **Godart** and others, with the moderns, **Dejean**, **Germar**, **Erichson**, **Burmeister**, &c. &c., have included a large number of our species in their works; but still the cultivation of our field may be said to have been just begun, thousands of our insects still remaining undescribed.

In August, 1842, the Entomological Society of Pennsylvania was formed at York, by a few energetic naturalists, who are pursuing the subject with a very commendable zeal. They have already described and published in the Proceedings of Acad. Nat. Sci. of Phil. more than six hundred new species of *Coleoptera*, and many more still remain to be determined. They have prepared a Catalogue of the *Coleoptera* of the United States, which will be of great value to all who study this subject. This institution, though yet in its infancy, will contribute much to the promotion of the science in our country, especially in the discovery of new species. All the active members have been honored by election to membership of various scientific societies at home, and two of them have received diplomas from abroad. The members are in possession of valuable books on the subject of entomology, and their collections of insects are large and constantly increasing.

Not a few gentlemen of taste in our country collect insects merely as objects of beauty, who do not study the science; but they promote it in some degree, for they sometimes capture species entirely unknown to entomologists.

There are not a few foreign collectors in our country, sent out by learned societies or universities. They send home an immense number, many of which are described and published in foreign journals and books. I lately saw a work of the celebrated **Erichson**, of Berlin, in which more than three hundred species of but a single family (*Brachelytra*) of North American *Coleoptera* are described. He of course will have the credit of doing that which should long ago have been done by our *native* naturalists.

The science is taught at several of our colleges. Dr. **Harris** delivers a course of lectures on the subject at Cambridge, Prof. **Adams** at Middlebury, the writer of this article at Pennsylvania

College, Gettysburg, and probably other institutions have made similar provision.

The collections of insects in this country, though not numerous, are in many instances very respectable. Dr. **Melsheimer's** is the richest in native species that I have seen in this country. Dr. **Harris's** is doubtless very extensive. Major **Leconte's** must be valuable. Prof. **Haldeman**, in addition to that made by himself, now possesses the collection formerly owned by Prof. **Hentz**, containing many of our rarest species. Mr. **Ziegler's** of York, is increasing. My own contains upwards of seven thousand species of native and foreign *Coleoptera*, and a large number of *Lepidoptera*. Mr. **Peale's**, of Washington, is large and splendid, consisting chiefly of *Lepidoptera*. He has them arranged geographically, and not systematically, as most other collectors have. Dr. **Wilkens** of New Jersey, and Mr. **Wilcox** late of Brooklyn, N. Y. had magnificent collections; but it is not known to the writer whether they still retain them.

There are doubtless other *private* collections in the country, but they have not come within my observation. The *public* collections are not numerous. Several of our colleges are engaged in establishing them, and it is hoped that soon no cabinet of natural history will be considered to be complete, without a well arranged and correctly systematized collection of insects. That of Count **Castelnau** (M. **Laporte**) now deposited in the National Institute, Washington, is the largest and richest in the country. It is gratifying to learn that the Association of Geologists and Naturalists, at their last meeting in New Haven, directed their attention to this subject. A committee was appointed to prepare a Manual of North American *Coleoptera*, and **Melsheimer**, **Haldeman**, and **Leconte**, jr., are just the men to whom such a work may be entrusted. We may before long look for something worthy of their distinguished abilities.

This, as far as could be ascertained, is an imperfect sketch of the past and present state of entomology in our country. It will be seen that little, in comparison with other natural sciences, has been accomplished; but it is advancing, and new laborers are entering the field. It is hoped that it will soon occupy the high position which its interest and importance demand.

Art. III.—*Experiments and Observations on the Solar Rays;* by Edwin C. Leedom, M. D., of Plymouth, Montgomery Co., Pennsylvania.

The difference of heat acquired by a white and a black body, when both are equally exposed to the sun's rays, has long attracted the attention of observers. "If a black and a white glove are worn by the same person in the sun, the hand with the black glove will acquire the greatest degree of heat. Dr. Watson, the present Bishop of Landaff, covered the bulb of a thermometer with a black coating of Indian ink, and the mercury presently rose 10°. Black clothes heat more and dry sooner in the sun than white clothes."*

The following experiment was performed by Franklin.

"On a winter's day when the ground is covered with snow, take four pieces of woollen cloth of equal dimensions but of different colors, black, blue, brown and white, and lay them on the surface of the snow in the immediate neighborhood of each other. In a few hours the black cloth will have sunk considerably below the surface; the blue almost as much; the brown evidently less; and the white will remain precisely in its former situation."†

Having described upon a piece of black paper, a circle one fifth of an inch in diameter, I condensed the sun's rays with a lens upon the paper, so as just to fill this circle, which quickly produced an emission of smoke accompanied by the odor of burning paper. The rays were then concentrated upon a piece of white and perfectly clean paper, so as just to fill a circle about one twentieth of an inch in diameter; but no discoloration of the paper, emission of smoke, or any thing indicating an approach to combustion, could be observed. Now, it is apparent that the condensation of the rays within the smaller circle, must have been to that within the larger circle, as the area of the latter to that of the former, which, upon computation, will be found to be as 16 : 1.

From these experiments it appears that there is a vast difference between white and black opaque bodies, as regards the effects of the sun's rays upon them. Philosophers explain this difference, by supposing that white bodies reflect the greater part of the incident rays, and black bodies absorb them all or nearly all. "In black bodies, such as coal, &c. all the rays which enter their substance are absorbed, and hence we see the reason why such bodies are more easily heated and inflamed by the action of the luminous rays."* Sir DAVID BREWSTER here speaks as if the visible rays contribute as much to the increase of heat as the calorific rays, and also, as if both are acted upon by the coal, &c. in the same manner. But it is certain that the coal acts very differently on the former from what it does on the latter. The moment the rays fall on the coal, the white light which enters its substance disappears—it completely escapes the cognizance of the senses; but the caloric exists within the pores of the coal in a free state, and then escapes in a sensible manner.

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* Greg. Dict. of Arts and Sci., Article Black.

† Webster's Manual Chem. (Henry 105.)

It was the opinion of Sir ISAAC NEWTON, that the light which passes into the substance of an opaque body, is "variously reflected to and fro within the body till it happens to be stifled and lost." Later philosophers assert that the particles of bodies exercise a specific attraction over the particles of light. "When a portion of light," says the celebrated Sir DAVID BREWSTER, "enters a body and is never again seen, we are entitled to say that it is detained by some power exerted over the light by the particles of the body. That it is attracted by the particles seems extremely probable, and that it enters into combination with them and produces various chemical and physical effects, cannot well be doubted."† Now, as when the sun's rays fall upon coal or any black body, the greater part of the rays enter the substance of the body, as the intromitted white light is never again seen; but as the caloric exists in a free state, there is every reason to believe that the former, but not the latter, enters into combination with the body. The circumstance of the caloric's quickly effecting its escape from the internal parts of the body, by radiation and otherwise, affords positive proof that it is not acted upon by that specific attraction which, in all probability, detains the white light; nevertheless, it must be acted upon slightly by an attractive force of another kind, or else its total discharge from the internal parts of the body would be instantaneous, contrary to what is observed to occur.

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* Brewster's Opt., chap. xxxiv. † Opt., chap. xxxiv.

Since coal and all black opaque bodies appear to have the power of separating the intromitted white light from the caloric, of detaining the former and rendering it latent, and allowing the latter to exist within the pores in a free state, and since white opacity is the reverse of black opacity, it seems rational to infer that the action of white bodies upon light is the reverse of that of black bodies, that their particles attract and detain the caloric, but, having little affinity for the white light, a large proportion of the latter exists within the pores in a free state, and then escapes by radiation.

"Those bodies which possess the power of reflection in the highest degree, such as white metals, chalk and plaster of Paris, never reflect more than one half of the light which falls upon them; and coal reflects from its first surface only one twenty fifth of the white light."* Now, supposing that black paper possesses the same absorptive power as charcoal, and that the rays which pass into the substance of white paper are disposed of in the same manner as those which pass into the substance of black paper, it follows, that a condensation of rays equal to $1\frac{23}{25}$ upon white paper, should produce the same heating effect as a condensation of rays equal to 1 upon black paper. But it has already been shown, that, when the rays are condensed sixteen times as forcibly on white as on black paper, less tendency to combustion is produced in the former than in the latter. How can the disappearance of so much caloric be accounted for, unless it be supposed that the particles of the white paper attract and detain it, in the same manner that those of coal and other black bodies do the intromitted white light?

The opacity of blackness was ascribed by Sir Isaac Newton to an inability in black bodies to reflect light, owing to the extreme smallness of their particles. But it is now well known that black bodies reflect a considerable quantity of light. Coal reflects one twenty fifth of the rays which fall upon it, and other black bodies of greater density appear to reflect a larger quantity than this. Black marble or any dense black body, when highly polished, possesses sufficient reflecting power to form a tolerably good mirror. If a piece of white paper on which the colors of the spectrum are painted, be held before a highly polished black surface and viewed by reflection, the white paper and all the different colors will be distinctly seen. Having procured a piece of anthracite which possessed a smooth, glossy surface, I concentrated the sun's rays with a lens alternately upon the smooth surface of the coal, and a piece of white china of very fine grain and good polish, and threw the reflected rays upon a piece of black paper at a small distance from the focus. The rays which were reflected from the black surface, appeared to act upon the paper as quickly and as forcibly as those reflected from the china; a copious emission of smoke, accompanied with the odor of burning paper, being the result in each case. Pieces of phosphorus also were inflamed as quickly, and apparently at as great a distance, by the rays reflected from the coal, as by those reflected from the china. Indeed, when the two reflecting surfaces were examined by the microscope, the polish of the coal appeared to be inferior to that of the china.

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* Brewster's Life of Newton, chap. VII.

Hence it appears that black bodies possess the power of reflection in a high degree. Black opacity, then, cannot be owing to an inability in the particles of black bodies to reflect the sun's rays. But, since "coal does not transmit to the eye a single ray out of those which enter its substance,"* it must be admitted that the phenomenon of blackness is produced by the absence of free light from the pores of an opaque body.

As white opacity is the reverse of black opacity, and as white bodies appear to detain the greater part of the solar caloric which enters their substance, in the same manner that charcoal and other black bodies do the intromitted white light, there is strong reason to believe, that the white light being but feebly attracted by the particles of white bodies, a large proportion of it exists within such bodies in a free state, and then escapes from their pores by radiation, as caloric does from heated bodies, and that this radiation of free white light from the pores of opaque bodies produces the phenomenon of whiteness. That the existence of free white light within the pores of an opaque body, even coal, would produce whiteness, is admitted by Sir DAVID BREWSTER himself. In his refutation of that part of the Newtonian theory which ascribes opacity to a multitude of reflections within the internal parts of bodies, he says: "If the particles of light were reflected or merely turned out of their direction by the action of the particles, it seems to be quite demonstrable that a portion of the most opaque matter, such as charcoal, would when exposed to a strong beam of light, become actually phosphorescent during its illumination, or would at least appear white."*

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* Brewster's Life of Newton, chap. VII.

The circumstance of the caloric's existing in a free state in the pores of black bodies, and becoming latent in white bodies, affords a ready explanation of the difference of heat acquired by a white and a black body, when both are equally exposed to the sun's rays. It is free, uncombined caloric which occasions the sensation of heat, causes the mercury to rise in the tube of the thermometer, overcomes the cohesive attraction of the particles of coal, &c. and enables them to combine with oxygen and produce the phenomenon of ordinary combustion.

Philosophers, for a long time, supposed the action of natural bodies upon light to be purely mechanical. Sir Isaac Newton, finding the least parts of many bodies to be in some measure transparent, supposed the colors of all bodies to be produced by their power of reflecting some rays and transmitting others, and their "opacity to arise from a multitude of reflections caused within their internal parts." "The transparent parts of bodies," says that great philosopher, "according to their several sizes, reflect rays of one color, and transmit those of another, on the same ground that thin plates or bubbles do reflect or transmit these rays; and this I take to be the ground of all their colors."†

Sir David Brewster, although he doubts not that the "Newtonian theory is applicable to colors of the wings of insects, the feathers of birds, the scales of fishes, the oxidated films on metal and glass, and certain opalescences, still believes that the colors of vegetable life, and those of various kinds of solids, arise from a specific attraction which the particles of these bodies exercise over the differently colored rays of light." "When," says he, "colored bodies are opaque, so as to exhibit their colors principally by reflection, the light which is reflected back to the observer, has received its color from transmission through part of the thickness of the body, or, what is the same thing, the color reflected to the eye, is complementary to that which has been detained by the particles of the body, while the light is passing and repassing through a thickness terminated by the reflecting surfaces," &c.*

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* Brewster's Opt. chap. xvi.

† Opt. chap. xxxiv.

The arguments advanced by this philosopher, in support of the opinion that the particles of bodies exercise a specific attraction over the particles of light, are forcible and convincing; but that part of his theory, which has for its object the determination of the manner in which the colored light is discharged from colored opaque bodies, will not, it appears to me, bear a thorough examination. When he says that "the color reflected to the eye is complementary to that which has been detained by the particles of the body, while the light is passing and repassing through a thickness terminated by the reflecting surfaces," he means, I presume, that the colored light is reflected to the eye from the second surface of a thin transparent stratum, the complementary light having been detained by the particles composing this stratum. According to this theory, the thinnest strata of all colored opaque bodies are transparent. But this is by no means certain. There is reason to believe that the thinnest film which can be formed of any metal is opaque. Gold leaf, it is true, transmits a portion of colored light, but, when it is examined by the solar microscope, it is said that innumerable rents can be perceived within it; wherefore, it is probable that the light which is transmitted passes through openings which have been caused by a forcible separation of the particles. The gold which covers the silver of which gold wire is formed, is vastly thinner than gold leaf. According to the computation of Dr. HALLEY, the ten thousandth part of a grain of gold covers a piece of wire one eighth of an inch in length, "and yet, though the gold with which such wire is coated is stretched to such a degree, so intimately do its parts cohere, that there is not any appearance of the silver underneath."† Even supposing a colored opaque body, a piece of gold for instance, to be composed of thin transparent strata, still, it is difficult to conceive how there can be any reflection except from the first surface of the gold, unless it be supposed that the layers are separated from each other by interstices filled with a medium of less density than the gold itself. As gold is a simple substance, the layers must all be equally refracting media. If the strata be supposed to be closely joined together, without any interstices between them, there certainly can be no reflection at their intervening planes; for, it was established by Sir ISAAC NEWTON as a fundamental principle, that within "the confines of equally refracting media there is no reflection." Indeed, that there is underneath the first surface of gold any other surface which reflects light, appears to me in the highest degree doubtful. Unless I misapprehend the passage quoted on the preceding page from Sir DAVID BREWSTER, his explanation of the mode in which the colored light is discharged from colored opaque bodies, is based altogether on imaginary data, and must therefore fail to give entire satisfaction to the true inquirer.

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* Life of Newton, chap. VII.

† Greg. Dict. of Arts and Sci., Articles Ductility and Wire.

When the sun's rays fall upon a piece of anthracite or any dense black opaque body, part of the caloric, as has been already demonstrated, is reflected from the outer surface, and part of it enters the body. A large proportion of that which enters the body exists within it in a free state, and then escapes from its pores by radiation and otherwise. Except as regards their effects upon animal bodies, the one causing the sensation of heat, the other that of vision, the rays of caloric and the rays of color bear the greatest resemblance to each other. They both come from the sun to the earth in the same time; they are both refracted in the same manner by lenses, and reflected by specula; and are equally the products of ordinary combustion. Now it appears to me, that this analogy gives strong support to the opinion, that a part of the light which enters into the substance of colored opaque bodies, exists within them in a free state, and then escapes from their pores by radiation.

It will be admitted that the outer and inner particles of any simple body possess the same properties. When light falls upon an opaque body, "part of it is reflected or driven back, and part of it enters the body." If, as is maintained by Sir DAVID BREWSTER, and other eminent modern philosophers, the particles of bodies exercise a specific attraction over the particles of light, the outer particles of any colored, opaque, simple body, must attract and detain the same sort of rays that the inner particles do. The light which is complementary to that which has been detained by the outer particles of the body, must necessarily be driven off from the outer surface of the body together with the undecomposed white light. Also, it can readily be conceived that that part of the intromitted light, which is complementary to that which has been detained by the inner particles of the body, must exist within the body in a free state, and then effect its escape from the pores, by that self-repellent power of its particles which is known to exist, and is the cause of radiation.

That a part of the colored light which is discharged from any colored opaque body, proceeds from the outer surface of the body, there can be little doubt. Procure an opaque body whose color is one of the primary colors of the spectrum, a piece of gold for instance, possessing a flat surface highly polished. The greater part of the light which is reflected from such a surface, is known to be reflected regularly. Throw the sun's rays obliquely upon the polished surface of the gold, and receive the reflected light upon white paper, which will be tinged of a yellow color. But, the yellow color thus given to the paper by the reflected light, will be very faint in comparison to the color of the gold itself—too faint to admit the belief that all the yellow light which is discharged from the gold proceeds from its outer surface; but no more vivid than can readily be accounted for, by supposing it to be complementary to the light which has been detained by the outer particles of the gold.

The brilliant colors of certain solid bodies, such as chromate of lead, indigo, &c., cannot, I think, be explained unless we call in to the aid of reflection a copious radiation of colored light from the internal parts of these bodies.

To the opinion that part of the light which enters the substance of colored opaque bodies exists within them in a free state, and then escapes from their pores by radiation, as caloric does from heated bodies, it might be objected, that the discharge by the bodies in question of all the light which is not permanently detained by the specific attraction of their particles, is instantaneous, but that a heated body requires some time to part with all its free caloric. But there is no proof that the discharge by the bodies in question, of all their free light, is instantaneous. When the color of a body ceases to make an impression upon the organ of vision, that is no proof that no more visible rays are discharged from the body. The human perceptions are not always unerring guides in tracing the operations of nature. It is well known that a body may feel cool to the touch, and yet, at the same time, radiate caloric. There is reason to believe that white and colored opaque bodies continue to discharge visible rays some time after they are deprived of all accessions of light from any external source. When there is snow on the ground, its whiteness is perceptible, let the night be ever so dark and cloudy. This opinion is also strengthened by the circumstance of some of the lower animals, owing to a more delicate structure of the eye, being able readily to distinguish objects in what would be total darkness to man. "The pupil admits of greater dilation in the cat, in the owl, in night birds, and in general in all animals that see in the dark. The retina likewise appears more sensitive in those animals; several of them appear incommoded by the light of day, and never pursue their prey but in the most obscure darkness."*

That light, after being absorbed by opaque bodies, can exist within them in a free state, and then escape from their pores by a self-repellent power of its particles, is admitted by Sir DAVID BREWSTER. In the latter part of the eighth chapter of his Life of Newton, in which he advances a new theory of inflection, I find the following passage.

"That the particles of light, like those of heat, are endowed with a repulsive force which prevents them from accumulating when in a state of condensation, or when they are detained by the absorptive action of opaque bodies, will be readily admitted." It appears to me somewhat remarkable, that this important idea was excluded from his "New Theory of Colors."

The proper colors of opaque bodies certainly depend but little upon the light which is reflected from their external surfaces. Let a small piece of black marble which has a flat surface well polished, be held in a particular manner between the eye and a sheet of white paper. Every part of the flat surface of the marble will reflect to the eye a part of the image of the paper, so that the whole of the surface will appear white. Instead of the sheet of paper, substitute a large piece of red cloth, and the surface of the marble will appear red; if yellow cloth be substituted for the red cloth, the surface of the marble will appear yellow, and so on. Now this shows that the native blackness of the marble is owing to no deficiency of reflecting power. But further, coal reflects from its external surface one twenty fifth of the incident light; and a white body, such as chalk, reflects about one half of the light which falls upon it. Let a quantity of white light equal to two, fall upon a piece of chalk, and another quantity of white light equal to twenty five, fall in the same direction on a piece of charcoal of the same size and shape as the chalk, and which has the same position. Under these circumstances the charcoal must reflect as much white light as the chalk. But the coal will still appear black, while the chalk will preserve its whiteness.

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* Richerand's Physiology, chap. VII, p. 215.

The explanation of white and black opacity given by optical writers, must be erroneous; for, the whiteness of chalk is perceptible in a dark, cloudy night, whereas charcoal appears intensely black, even though viewed by the direct light of the sun, when the sky is cloudless and the ground covered with snow.

It is asserted by Sir DAVID BREWSTER, that "coal does not transmit to the eye a single ray out of those which enter its substance." Now, if when an opaque body discharges no light whatever from its internal parts, we have the phenomenon of blackness, even though the quantity of light reflected from its external surface is considerable, it must I think be admitted, that when such a body possesses a proper color, its color is owing to the radiation of colored light from its pores.

In making a brief recapitulation of the views unfolded in this paper, I would say that the particles of all opaque bodies exercise over the intromitted rays a specific attractive power. Those of coal and other black bodies attract and detain the white light, but, having a feeble affinity for the caloric, the latter exists within such bodies in a free state, and then escapes from their pores by radiation and otherwise; the particles of white bodies detain the caloric, but, having less affinity for the white light, a large proportion of the latter exists within these bodies in a free state, and then escapes from their pores by radiation; and the particles of a body whose color is one of the primary colors of the spectrum, attract and detain the light which is complementary to that which gives the body its proper color, the latter, being left free, escapes from the internal parts of the body, by that self-repellent power of its particles which is known to exist, and is the cause of radiation.

This theory is one of extreme simplicity; but it is not for that reason the less likely to be true. We are taught by Sir ISAAC NEWTON, that "Nature does nothing in vain, but is simple, and delights not in superfluous causes of things."

Art. IV.—*Some facts respecting the Geology of Tampa Bay, Florida;* by John H. Allen, Principal of Chilicothe Academy, Ohio, and late Lieut. of Artillery in the U. S. Army in Florida.

The peninsula of Florida presents many interesting geological features; it is evidently of an origin comparatively recent, and its rocks and marl beds are replete with a vast quantity and rich variety of organic remains, which have as yet been but imperfectly examined. This region is not only attractive to the geologist, but to the naturalist in every department. Along the borders of its rivers and in its rich hammock lands, are found a profusion and variety of trees, shrubs and plants, which excite admiration by their magnificence and beauty. It swarms with beautiful insects of every hue; and in the shallow waters of its bays live myriads of shell fish, belonging to a great variety of species.

One of the most interesting points in Florida to the geologist is the neighborhood of Fort Brooke at the head of Tampa Bay. The first layer of solid rock beneath the soil is a stratum of limestone; it is hard and white, has an earthy texture, and appears to have resulted from comminuted and decomposed shells. The surface of this rock is exposed in several places in the vicinity of Fort Brooke, about two miles north, near the Hillsboro' river, four miles west on the shore of the bay, and six or seven miles east in the banks of a small stream. This rock has a very extensive range. I have seen it in many parts of the territory;—in some places it is soft and friable, very much resembling chalk, all traces of organic remains having been obliterated by the decomposition of its material previously to its consolidation. I have noticed it at points more than one hundred and fifty miles distant from each other, presenting the same lithological characters. It constitutes the bottom of the many ponds and lakes in the interior, and I have been informed, that its white and jagged surface can be seen throughout the whole extent of the everglades, that singular sea of fresh water and coarse grass, that covers an area of several thousand square miles in the southern part of the peninsula. This immense volume of fresh water must be forced up through crevices in this rock.

This limestone in some places is destitute of organic remains, in others it contains a great abundance of them, such as univalves, bivalves and echini; where it has been exposed to the disintegrating influences of the atmosphere, beautiful specimens can be detached. It has in many places sunk down and left depressions called *limesinks;* which often have a small area and are several feet in depth, appearing more like artificial wells than natural productions. The loose texture and proximity of this rock to the surface accounts for the fact, that the sandy soil of the country contains a large proportion of lime in its composition and possesses a greater fertility than its aspect promises. I have never seen any chert in the limestone, but from the frequent occurrence of nodules of that mineral on the surface, I should infer that they came from it. This rock must be several feet in thickness, for extensive caverns and galleries are found in it, worn out by subterranean streams; there is a small excavation near Fort Brooke, running many feet horizontally and nearly high enough for a man to stand upright.

There is another rock that probably dips beneath the limestone—a dark bluish, silicious rock, of a compact texture, somewhat vesicular, the vesicles containing minute crystals of quartz. This rock can be seen at the rapids of the Hillsboro', about nine miles north of its mouth. I have noticed bowlders of it at several places in the interior, particularly near the forks of the Withlacoochee river, containing beautiful impressions of bivalve shells. This and the limestone are the only compact rocks I have ever seen in the peninsula. Small bowlders of a gray sandstone occur a few miles north of Fort King.

In the vicinity of the Hillsboro' river and other streams that discharge their waters into Tampa Bay, are several sulphur springs, which issue from crevices in the rocks, and supply a copious quantity of water charged with sulphureted hydrogen gas. There is a very large one near the west bank of Hillsboro' river, about eight miles north of Fort Brooke; it is thirty feet or more in diameter and twelve feet deep, and issues from a crevice in the underlying rock, throwing out sufficient water to form a stream more than twenty feet wide and eighteen inches deep, which bubbles up with so much force as to keep the surface in a constant agitation like the boiling of a large caldron. The waters of this spring are so pellucid that minute fragments of shell glisten on the bottom like pearls, and large turtles with a great variety of fish are seen swimming about; from the number of fish, I inferred that they are fond of frequenting sulphureted waters. When I visited this spring, the stream flowing from it into the Hillsboro' river was literally crowded with them. These springs are very abundant; there is a small one southwest of the fort, near the western shore of the bay, and a large one about seven miles east; some species of shell fish live in the streams that flow from them. A species of Neritina, that is very abundant in the brackish waters at the head of the bay, seems to have a great predilection for these sulphurous waters, in which the individuals grow to a greater size than they attain elsewhere.

There is a peculiar beauty and placidity in the springs of Florida, embosomed as they are with a perennial foliage, that might well have confirmed the Spanish adventurer Ponce De Leon in the belief that some one of them possessed the power of removing the decrepitude of age, and restoring the freshness and elasticity of youth.

Along the shore of Tampa Bay, the country is low, seldom attaining a height of more than ten feet above the surface of the water; it is generally sandy, but in some places there are beds of marl, which when they form the surface, constitute a rich and fertile soil. These beds differ materially in their composition and organic contents; they evidently belong to different geological periods. One of the most ancient and interesting of these deposits can be seen about two miles west of Fort Brooke, where a section a few hundred feet in length has been exposed by the washing of the waters of the bay. Immediately back from the shore it is covered by three or four feet of loam and sand. This bed consists of blue marly clay, interlaminated with seams of carbonate of lime, which probably has resulted from the decomposition of shells; that which renders this deposit unusually interesting is the remarkably beautiful petrifactions that it contains, and that surpass any thing of the kind I ever saw. Interspersed throughout the marl are masses of silex presenting a great variety of shapes and colors; some have a rough and jagged surface and wine yellow color, some are hollow cylindrical tubes of different colors, straight or bent, from one to six inches in length, and from one fourth of an inch to one inch in diameter, with a fine drusy interior; others are beautifully agatized, having that moss-like appearance that agates sometimes possess; these silicious concretions are both opaque and translucent, and are probably of organic origin. There are also found in this bed round cylindrical stems, fluted and gradually tapering to a point with a slight curve, they are from three to four inches in length; likewise a species of large radiated coral, shaped like the segment of a sphere, petrified with wine colored silex, and having a mammillary interior of carnelian or chalcedony.* The most beautiful petrifactions of this deposite are various species of shells that are so perfectly petrified with clear wine colored silex, that all their most minute and delicate markings are preserved; so great is their translucency, one can nearly read through them. They appear to have petrified before having suffered the least from attrition or decomposition; the spiral univalves taper to a transparent needle-like point. I found one petrified with carnelian. I obtained more than twenty specimens, among others some of the following genera: *Murex*, *Oliva*, *Cyprea*, *Buccinum*, *Cardita*, *Trochus*, *Cerithium*, *Pura* and *Helix*, a few of which are found living at present in the bay, some are indigenous to the West Indies; they are washed out of the marl and strown along the shore by the constant action of the water. There are other beds of marl, apparently of a much more recent origin, one of which extends along the shore at Fort Brooke; it is an earthy mass containing vast quantities of oysters and other shells, extends a few hundred feet back from the shore, and is several feet in thickness. I have seen dug out of it bones of the *Manatus* or sea cow, an animal that still exists in the southern part of the peninsula.

Deposits of marl, and shell banks, occur at many places on the western coast of Florida. About thirty five miles south of Fort Brooke, near the mouth of the Manatu river, there is an extensive bank of shells ten feet or more in thickness, composed almost wholly of large unbroken univalves, belonging principally to a species of *Pyrula*, without any admixture of earth. I never before saw shells of this kind in such large quantities, and from their volume and position, I should infer that they had been amassed by the action of violent storms; they are abundant in the bay. All however which I have seen alive are of a smaller size, from which I should judge that the larger ones lived at some remote period, when a warmer climate and other circumstances were highly favorable to the development of molluscous life. I noticed fragments of Indian pottery amongst them; their immense quantity precludes the idea of their having been accumulated by the aborigines of the country.*

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* These beautiful fossils are well known in mineralogical cabinets as "chalcedony from Tampa Bay." In most of the geodes which we have seen from this locality, the zoophytic structure of the mass could be readily detected. One large hollow spheroidal or pyramidal specimen which we have, has numerous stalactical masses rising inward from its base of the size and length of a man's finger. These have arisen from the perforation of the original animal structure by saxicavous shells who had there taken up their quarters. When the silicifying influence (whatever it was) came on, the silica penetrated evenly all the cavities and inequalities of the original, copying with surprising delicacy, all the minute markings of the zoophyte.—*Eds.*

This place possesses much interest on account of its being the spot where De Soto landed his army. A short distance from the shell bank, are the remains of ancient fortifications, probably built on this occasion or subsequently by the Spaniards.

There are found along the shore at Fort Brooke, small beautiful fortification agates, which probably are washed out of the marl bed that contains the siliceous petrifactions. Deposites of ochre are found between the head of Tampa Bay and the Gulf of Mexico; and I have noticed near the marl bed, large masses of sand cemented by the oxide of iron.

To the botanist Florida presents a rich field of research; here he can behold in their native beauty and magnificence, a great variety of trees and plants—the lofty Gordonia, the gorgeous Magnolia, that perfumes the atmosphere with its fragrance, and the tall Palmetto, that gives an oriental appearance to the country. The ground in many places is carpeted with the delicate sensitive plant, and upon the trees grow a great variety of parasites, the most conspicuous and showy of which is the *Tillandsia utriculata*, whose long subulate leaves form at their base a depression, out of which rises a stem three feet high, covered with a profusion of white flowers, that produce a fine effect amidst the long moss (*Tillandsia usneoides*) that frequently invests the trees. The Hydrangea and the beautiful coral tree, (*Erythrina*,) are seen in their native luxuriance; and many vines, such as the Bignonia, Passiflora and Ipomea, trailing from trees and shrubs, delight the eye with their splendid flowers. Along the coast the mangrove (*Rhizophora*) forms an almost impenetrable mass of vegetation, by sending down from its branches vertical stems that take root in the soil.

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* It probably requires more investigation and comparison before we can safely say that the shells mentioned by Mr. Allen, are identical with those now living on the coast. It is quite probable that a large proportion of them are so.—*Eds.*

Art. V.—*Review of the New York Geological Reports.*

(Continued from Vol. xlviii, p. 316.)

In continuation of the New York Geological Reports, we proceed with the description of the

Onondaga Salt Group. (Not recognized in the Pennsylvania survey.)—In the geographical subdivisions of the New York System adopted by most of the New York geologists, this group forms the lowest member of the Helderberg series;* in the chronological table, it forms the second member of the middle division in the ascending scale.

As a whole it is an immense mass of argillo-calcareous shaly rocks, enclosing veins and beds of gypsum; hence this has been designated by some as the "gypseous shales." From the lithological character of these beds, their outcrop has suffered much from denudation, and their superficial area occupies a wider district of country than most of the preceding members, especially along the valley of the Clyde,—covered up from view, however, to a great extent, by accumulations of drift. To the east it runs out near Sharon Springs; west it extends into Canada, being coextensive with, and running parallel to the Niagara group, upon which it rests. Its superficial area is represented on the geological chart by a light ochre.

Four divisions have been distinguished in the description of the Onondaga salt group, though the lines of separation are by no means well defined.

1. Red and greenish shale below.
2. Green and red marl, shale and shaly limestone, with some veins of gypsum.
3. Shaly and compact impure limestone, with shale and marl, embracing two ranges of plaster beds, with hopper shaped cavities between.
4. Drab colored impure limestone with fibrous cavities; the "Magnesian deposit" of Vanuxem.

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* In Emmons's tabular view of the New York System, the "Onondaga salt and plaster rocks" are placed in the Ontario division. In a *geographical* arrangement this is perhaps the more correct grouping, since these formations are in full force along the valley of Lake Ontario, and are almost absent in the first geological district, where the Helderberg Mountains are situated.

Of these, the third is the only one that has yielded gypsum in profitable quantities. The included masses of gypsum, though, for the most part, even-bedded at their base, are usually very irregular at their upper surface, often conical. The plaster beds are supposed to be segregations by molecular attraction from the marl. Might it not have originated in the introduction of subterranean springs, charged with sulphuric acid or sulphates, bursting up through fissures in the inferior strata, and mingling with the waters of the ocean holding lime in solution, by which mounds and irregular beds of the resulting precipitated sulphate of lime would accumulate, isolated in a great measure from the deposites of calcareous mud going on around? Most of the gypsum is of a dull earthy color, and it usually effervesces with acids from the presence of carbonate of lime.

This third division contains not only the gypseous beds, but is, most probably, the source also of all the salt so extensively manufactured at Onondaga, Cayuga and Madison; at least VANUXEM informs us, that, except in these gypseous beds, there is no evidence of salt existing in the solid state in any of the other divisions of the Onondaga salt group. This author believes that the hopper-shaped cavities situated between the two plaster beds prove that salt has crystallized during the desiccation of the waters in which the surrounding deposite of argillaceous and calcareous matter was going forward, since, during the evaporation of brines, cubes of salt aggregate so as to form groups of crystals corresponding perfectly to such a matrix. Near the same geological position is the *Vermicular lime rock* of EATON, so called from numerous, disseminated, tubular cavities, which VANUXEM thinks are also due to previously existing common salt.

The fourth division is remarkable for a fine columnar structure or needle formed cavities dispersed through the mass. These VANUXEM believes to have been caused by crystallizations of sulphate of magnesia during the consolidation of the rock, and subsequently removed by percolation of water; for this reason he has denominated this part of the Onondaga salt group the "*Magnesian deposite*," and its cavities "*Epsomites*."

Connected with this formation, "between the two porous masses," the geologist of the third district has described "a mass of *altered* rock extending for many rods," which in structure par-takes, in part, of the character of serpentine, and, in part, that of granite and sienite, whilst some of the adjacent calcareous portions show a crystalline grain with streaks of a light bluish shale. These metamorphic products he conceives were not formed by a "dry heat or fire," but were the result of solution and crystallization from a thermal water.

We would inquire, is there unequivocal evidence that the metamorphic rocks are entirely cut off from all connection with inferior intrusive veins?—because, unless there is, we can perceive no good reason for denying to them an origin which is generally conceded to belong to geological formations of similar structure. A microscopic, crystalline texture is certainly not incompatible with fluidity or semi-fluidity by dry heat. Is it not rather evidence of sudden consolidation?

The thickness of the first division of the Onondaga salt group on Steele's Creek, is estimated at eighty feet, but in Onondaga County its maximum is five hundred feet, unproductive of any valuable mineral. The exact thickness of the other divisions does not appear to have been ascertained, probably for the want of favorable sections. We are informed, however, that a well had been sunk at the Indian Reservation to the south of Vernon Village, eighty feet through strata belonging to the second division; these borings were commenced below the range of the plaster beds. Some of the plaster quarries in the third division have exposed from twenty to sixty feet of strata above the gypsum deposite. In Madison County the upper and lower porous or vermicular limestones are together twenty four feet. In the middle counties the entire thickness of the Onondaga salt group must be from six hundred to a thousand feet.*

Notwithstanding its great thickness, this formation is very barren in fossils. The corals and shells of the Niagara group suddenly ceased to exist, perhaps, as HALL suggests, being overwhelmed by the sudden outbreak of a mud volcano at the bottom of the ocean, by which the waters became surcharged, not only with argillaceous sediment, but became contaminated either with free sulphuric acid, or sulphate of magnesia and soda.

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* HALL, at p. 133 of the Report of the Fourth District, speaking of the immense accumulation of mud on the top of the Niagara limestone as caused by a mud volcano, estimates it at a thousand feet.

The only organic remains yet discovered in the group in question, are, the head of a trilobite, *Eurypterus remipes*, and the forms represented beneath.

Hall's Report, p. 137.

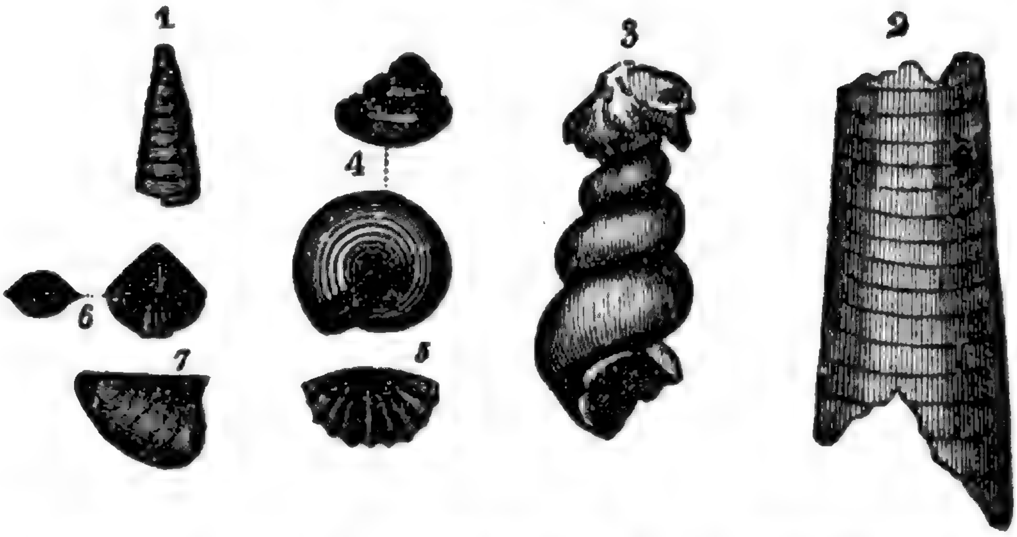


Fig. 1. *Cornulites*, n. s. 2. *Orthoceras læve*, H. 3. *Loxonema Boydii*, H. 4. *Euomphalus sulcatus*, H. 5. *Delthyris* ——? 6. *Atrypa* ——? 7. *Avicula triquetra*, H.

"These all occur at a single locality, and but one other shell has been seen in the group."

If any portion of the Onondaga salt group exists in the West, it is but obscurely marked. None of the above fossils have come under our notice in the Western States; but in the Du Buque district of Iowa, and on the opposite side of the Mississippi in Illinois, on section fourteen, township twenty five north, range seven east of the fourth principal meridian, a vermicular lime rock was discovered, answering to the description of the porous beds of the third division of the Onondaga salt group. If this has originated, as has been suggested, in crystallizations of muriate of soda, it cannot be considered much evidence in favor of the identity of the two formations; but the transverse septa and lamelliferous, cellular structure, visible in some specimens from the western formation, leaves little room to doubt *their* organic origin.

The country through which the Onondaga salt group extends, is usually marked by a series of low gravelly hills and clayey valleys, on which a stunted growth of timber prevails, known by the name of "Oak openings."

Small portions of sulphate of strontia, galena and blende, with rhomb spar, occur in the upper portion of the group. Gypsum and salt are, however, the only minerals of economical value; of the former many thousand tons are annually excavated. Several acidulous springs issuing from these deposites, have been found to contain free sulphuric acid.

Water Lime Group. (A part of No. 6 of the Pennsylvania survey.)—For better distinction known also as the "Manlius water lime," since the terminal division of the last group, according to Hall, assumes, in the region around Cayuga Lake, the character of a water lime, and is employed, like the rock now to be described, as a hydraulic cement.

The Manlius water limestone consists of drab colored layers interstratified in a mass of darker blue limestone. The thickness of the whole varies from thirty to a hundred feet, but only a few feet of this is suitable for hydraulic purposes. The layer most highly esteemed for cement, is from four to five feet thick, of a drab color, and fine grained, traversed by oblique cracks in at least three directions, which causes it to break into irregular fragments. At some localities siliceous nodules are interspersed; then it is no longer fit for a water lime. An interlamination of shale is also destructive of its economical value, since an excess of argillaceous matter is very injurious to such cements.

The individual layers are not unfrequently interlocked by a notched surface not unlike the sutures of a skull; this appearance Vanuxem attributes to crystallizations of sulphate of magnesia.

On the chart, the water lime is represented by a grayish blue band, narrow and rather tortuous in its course, whose general direction is nearly west and east, from Niagara river to Schoharie, thence with a southerly curve along the Helderberg range to the Mamakating Valley. It exists also out of this general range in the base of Becraft's Mountain and Mount Bob, outliers of the Helderberg, east of North River, near the city of Hudson.

The typical fossils of the group given in the Reports, are embraced in the following wood cut.

Vanuxem's Report, p. 112.

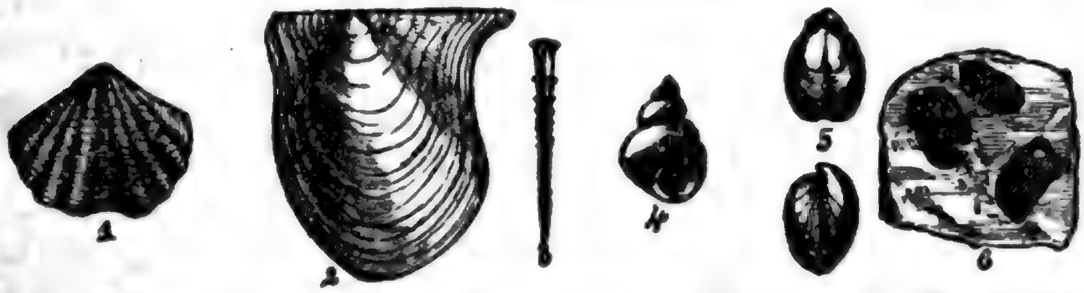


Fig. 1. *Delthyris plicatus*. 2. *Avicula rugosa*, Conrad. 3. *Tentaculites ornatus*, Sil. Res., p. 12, fig. 25. 4. *Littorina antiqua*, Conrad. 5. *Atrypa sulcata*, Vanuxem. 6. *Cytherina alta*, Conrad.

Fig. 3 is believed to be identical with a fossil found in slabs of limestone at Dudley in England, whose origin is still a matter of speculation. Some suppose the *Tentaculites* to be arms of *Crinoïdea;* others think they may be spines of *Leptæna.*

A *columnaria*, a peculiar *Strophomena*, and an *Agnostis*, perhaps the *pisiformis*, are enumerated as occurring in this formation.

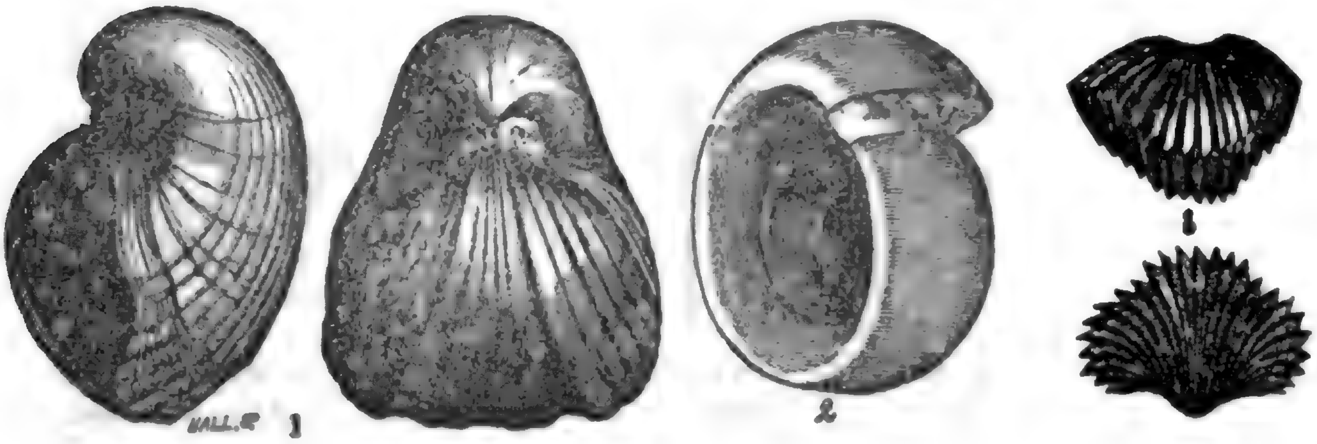
It is doubtful whether any strata identical with the water lime group of New York, exists in the West. It is true that one of the uppermost beds on the Falls of the Ohio is lithologically the same, and contains a *Tentaculites* and an *Avicula;* but they appear to be of species distinct from those which have been found in the New York water lime; besides, as we shall by and by see, the western hydraulic limestone is superimposed on beds which contain fossils identical with some in the upper Helderberg series, which proves it to occupy a higher geological position.

Pentamerus Limestone. (Part of No. 6 of the Pennsylvania survey.)—This, the third member of the Helderberg series, has received its name from the constant occurrence of a helmet-shaped *Pentamerus*, fig. 1 of the following wood cut. The name however is very objectionable, inasmuch as it does not distinguish it from other Pentamerus beds both below and above it.

This limestone, though well developed in the southern part of the state all along the Helderberg range, and in some of the middle counties, is not a universal formation. In thickness it varies from ten to eighty feet, and usually presents the appearance of an uneven bedded, rough, subcrystalline and highly fossiliferous, blackish gray, slaty limestone, with an interlamination of shale.

The fossils figured in Vanuxem's report, as characteristic of the Pentamerus limestone, are here given.

Vanuxem's Report, p. 117.



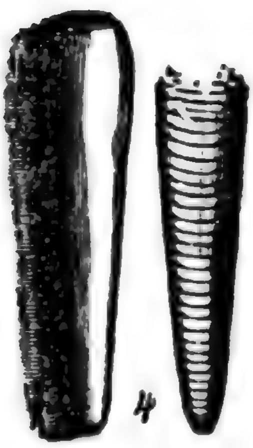
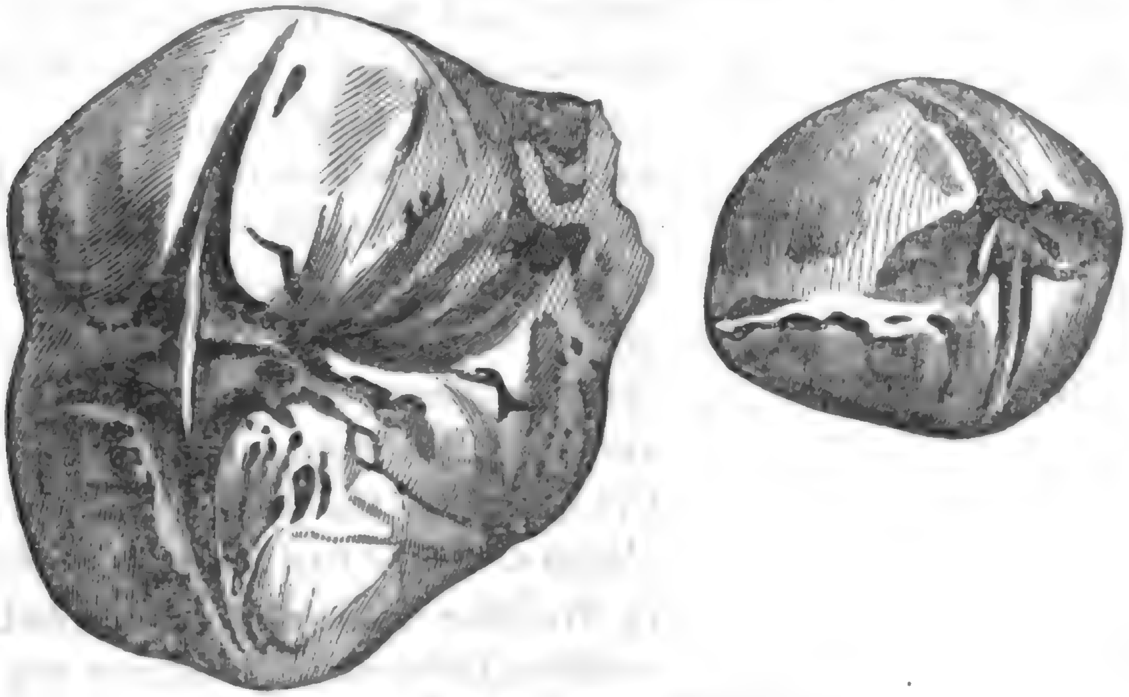


Fig. 1. *Pentamerus galeatus.* , *Atrypa galeata*, Dalm. 2. *Euomphalus profundus*, Conrad. 3. *Atrypa lacunosa?* *Terebratula lacunosa* of Europe. 4. *Lepocrinites Gebhardii.*

It is supposed that Fig. 1 may be identical with the *Atrypa galeatus* of the Wenlock limestone. The English fossil seems, from a comparison of figures, to be of a more globular form, and to have its ribs more strongly marked, than the New York specimens; but these shades of difference are, perhaps, no more than we have reason to expect in the same species at distant points in their geographical range. The disparity in their generic names arises from the *Atrypa* and *Pentamerus* being distinguishable only by their internal structure, the latter being provided with internal vertical laminæ or projections, which give to its internal cast for a certain distance from the hinge five divisions, as is here represented, which are not observable in casts of the former. But it may be asked, may not this internal structure vary with the circumstances under which the fossilization has taken place? Might not the internal supports, under certain conditions, be absorbed during petrifaction without leaving any impress, either on the internal cast or inner concavity of the fossil shell? Is it not the rarest thing to find the spiral appendage of the *Spirifer* preserved? And has not its synonym *Delthyris* originated from this very cause?



Internal Casts of *Pentamerus.* Iowa.

Fig. 4 shows the outer and *inner* (?) structure of a *Crinoïdean* figured in a more perfected condition in Mather's report, p. 346, and first known as the Mulberry *Encrinite.* It is characteristic of the middle part of the *Pentamerus* limestone, according to that author, whilst the *Asterocrinites pachydactylus*, fig. 6, p. 346, of the same report, is confined to the base of this limestone.

The other fossils named and described found in this formation, are, *Strophomena raristriata*, *S. rectilateris*, *S. depressa*, *S. elongata*, *Avicula naviformis*, *A. manticula.* "It also contains, according to VANUXEM, two *atrypæ* of a kind which first appear in this district and State in this rock, and there are three in all. Beyond this State there are others, one of which, being *A. capax* of CONRAD, exists in a lower position in Ohio and Indiana; the third, *A. cuboides*, is confined to the *Tully* limestone. The two found in the *Pentamerus* limestone closely resemble the *Terebratula Wilsoni* of English geologists." Nothing has yet been identified in the West, corresponding to this *Pentamerus* limestone.

Catskill Shaly Limestone, (*Delthyris Shaly Limestone, and Scutella Limestone of the yearly reports.*) (Part of No. 6 of Pennsylvania survey.)—This is one of the thickest members of the Helderberg series, and ranges all through the southern counties, extending as far west as the east end of Madison County. It is composed of "a dark bluish grey shale, with a fine grained blue limestone beneath, and a coarse limestone above;" the latter containing a great number of a discoidal-shaped fossil, probably the pelvis of an *Encrinite*, which bears a resemblance to a *Scutella;* hence has arisen the term, "*Scutella* limestone," as applied to the upper division of this formation. "Sparry limestone" is a synonym employed by GEBHARD to designate the same rock. In the first or southern geological district, where this group is upwards of a hundred feet thick, three divisions have been recognized.

a. An upper, coarse, uncrystalline limestone, containing a great many shells and *Encrinites* along with some corals,—Catskill shaly limestone.*

b. A middle slaty limestone equally fossiliferous.

c. A lower slaty argillo-siliceous limestone, abounding in *Strophomena rugosa*,† fig. 2, p. 312 of Vol. XLVIII, of this Journal.

The whole comprises, according to MATHER, a series of strata, perhaps, more highly fossiliferous than any rock of equal thick-

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* In HALL's report this division is described as a distinct formation under the name of "Encrinital limestone."

† Since the former number of the Review was written, we have seen specimens of this fossil. It is much larger and more strongly wrinkled than the western fossil there spoken of.

ness in the state. Many of its organic remains are in a wonderful state of preservation, so that under the lens, the most minute structure of the smallest corals can be discerned.

The best sections are exposed on Catskill Creek, in Greene County, along the railroad. This locality gave origin to the name by which this formation is usually designated. It is also well exposed near the village of Schoharie, at Sharon Springs; near the Great Falls of Esopus, and at Rochester in Ulster County. Outliers of all the three divisions, besides other members of the Helderberg series, exist on the east side of North River, on Becraft Mountain and Mount Bob near Hudson, lying unconformably on the subjacent slaty rocks.

A few of the most common fossils are embraced in the following wood cuts.

Hall's Report.

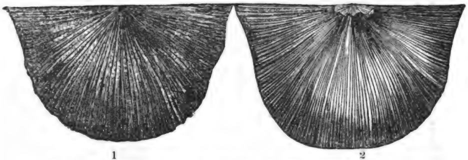

Fig. 1. *Strophomena punctulifera*, Conrad. 2. *Strophomena rudiata*, Conrad.

"These fossils occur in the *Delthyris* shaly limestone of New York, but at the West the *S. punctulifera* holds a higher position."*

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* Does Mr. Hall mean by "West," the Western States or the western part of the State of New York? We are not aware of the *S. punctulifera* having been found in the Western States.

We understand Mr. Hall to say that he found *Strophomena* near the Falls of Ohio, which at the time he considered *S. punctulifera*; but all the *Strophomena* are *punctate* or *striato-punctate* when the shell is removed or partly removed, and there is great difficulty in identifying the one intended by Conrad as *S. punctulifera*, which is not *punctate* when the shell is perfect. By "West" Mr. Hall means the Western States.—*Eds. Am. Jour. Sci.*

Hall's Report, p. 120.

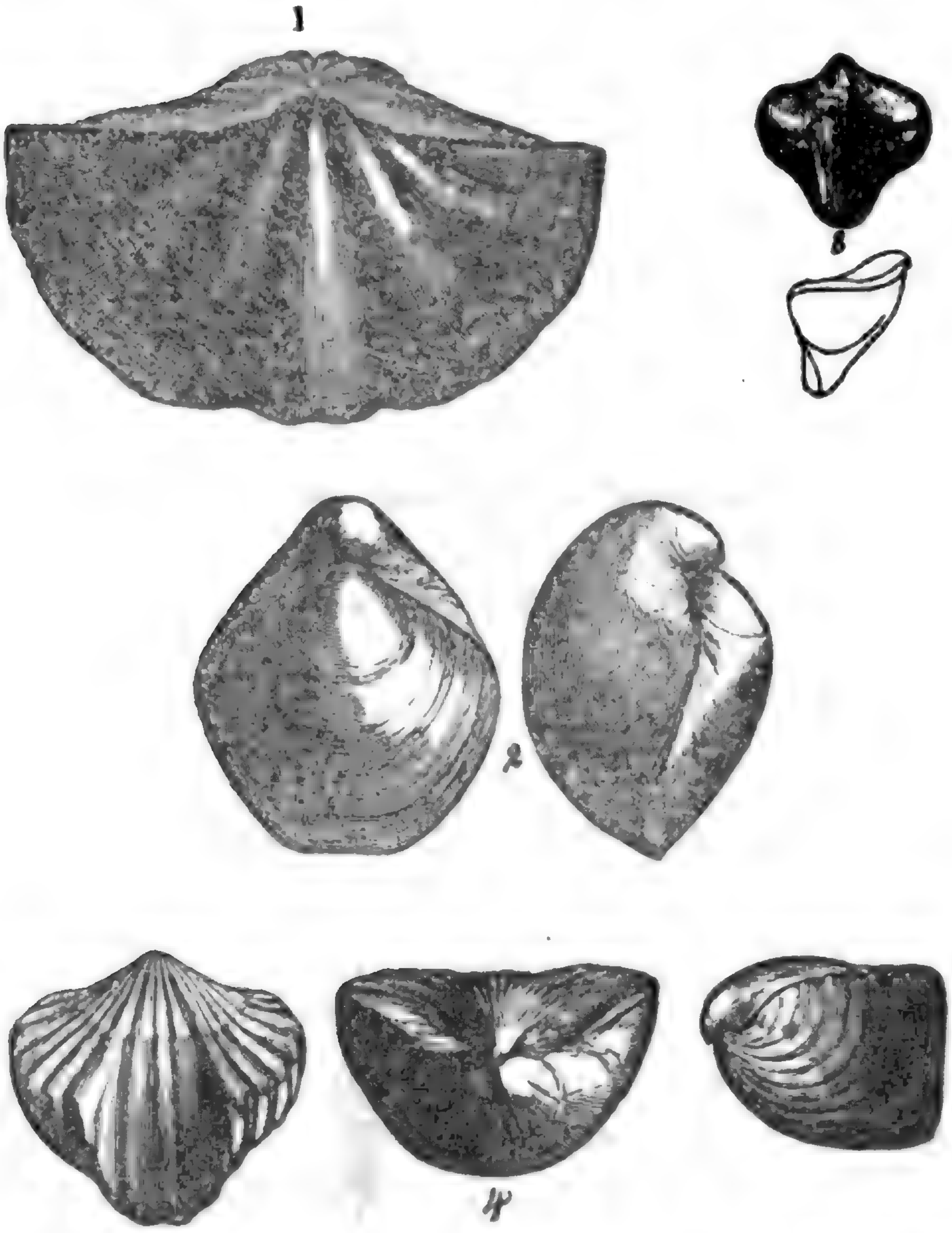


Fig. 1. *Delthyris macropleura.* 2. *Atrypa lævis.* 3. *Atrypa singularis.* 4. *Atrypa medialis.*

We have not been able to identify these forms with any western fossils which have as yet come under our notice. There is, therefore, neither palæontological nor lithological evidence, at present, of the existence of equivalent beds in the Western States or Territories.

Amongst the numerous beautiful fossils of the Catskill shaly limestone not yet published, there are several which Hall informs us are very analogous to the following forms figured on Pl. 13 of the Silurian Researches, and found in the Wenlock shale of England,—*Orthis hybrida, O. canalis, Atrypa rotunda, A. linguifera*, and several others.

The following is a list of fossils of this formation which have been described by Conrad in the annual reports:—*Acidaspis tu-*

berculatus, *Acanthaloma*, *Asaphus pleuroptyx*, *Asaphus nasutus*, *Dicranurus*, *Calamopora* (*favosites*) *favosa*, *Delthyris bilobata*, *D. granulosa*, *D. macropleura*, *D. pachyoptera*, *Orthis*, *Strophomena indentata*, *Atrypa prisca*, *A. inflata*, *A. concentrica*, *Platyceras ventricosum*, *P. Gebhardii*, *Calceola plicata*, *Conularia quadrisulcata*, *Tentaculites scalaris*.

Gebhard, jr., has distinguished a limestone resting upon, yet distinct from the Catskill shaly limestone, under the name of the "upper *Pentamerus* limestone," which contains a smooth species of *Pentamerus*, in its general form like *P. galeatus*; also several forms of *Atrypa* similar to those which occur in the inferior beds of this group.

Oriskany Sandstone. (No. 7 of the Pennsylvania survey.)—Though this formation, in some parts of the first district, is only a few inches thick, and never exceeds in any part of the State of New York thirty feet, yet in Pennsylvania and Virginia it becomes a very conspicuous member of the Appalachian system, attaining, in the former state, the enormous thickness of seven hundred feet. In New York the Oriskany sandstone is confined chiefly to the middle and southern portion of the state, not extending further west than Morganville, Genesee County.

Its lithological character is, for the most part, a tolerably pure siliceous or quartzose sandstone of a white or yellow color. At Schoharie and the Helderberg generally, it becomes, however, a compact, tough, siliceous limestone. Very frequently it is full of cavities, the hollow moulds of shells which chemical agencies have removed. It is worthy of note, as Vanuxem remarks, that "this sandstone and the calciferous sand rock, including the Potsdam sandstone, are the only two rocks of the third district, (and we presume also in every part of the state over which the New York system extends,) which presents unaltered the pure sand of the primary region."

From the irregular thickness of the Oriskany sandstone in the middle part of the state, and the apparent depressions which it fills up on the surface of the Onondaga salt group, where the intervening strata are absent, it has been suggested by Hall that the more elevated and exposed portions of this underlying formation might have been, during the deposition of the siliceous rocks under consideration, dry land, or at least was beyond the reach of detrital deposition, and that too for a long period, viz. whilst the deposition of the two *Pentamerus* limestones and interposed *Delthyris* shaly limestone was going forward; each of which formations must have required an immense lapse of time, since each contains a peculiar assemblage of fossils.

These are the most abundant organic remains of the Oriskany sandstone.

Vanuxem's Report, p. 133.

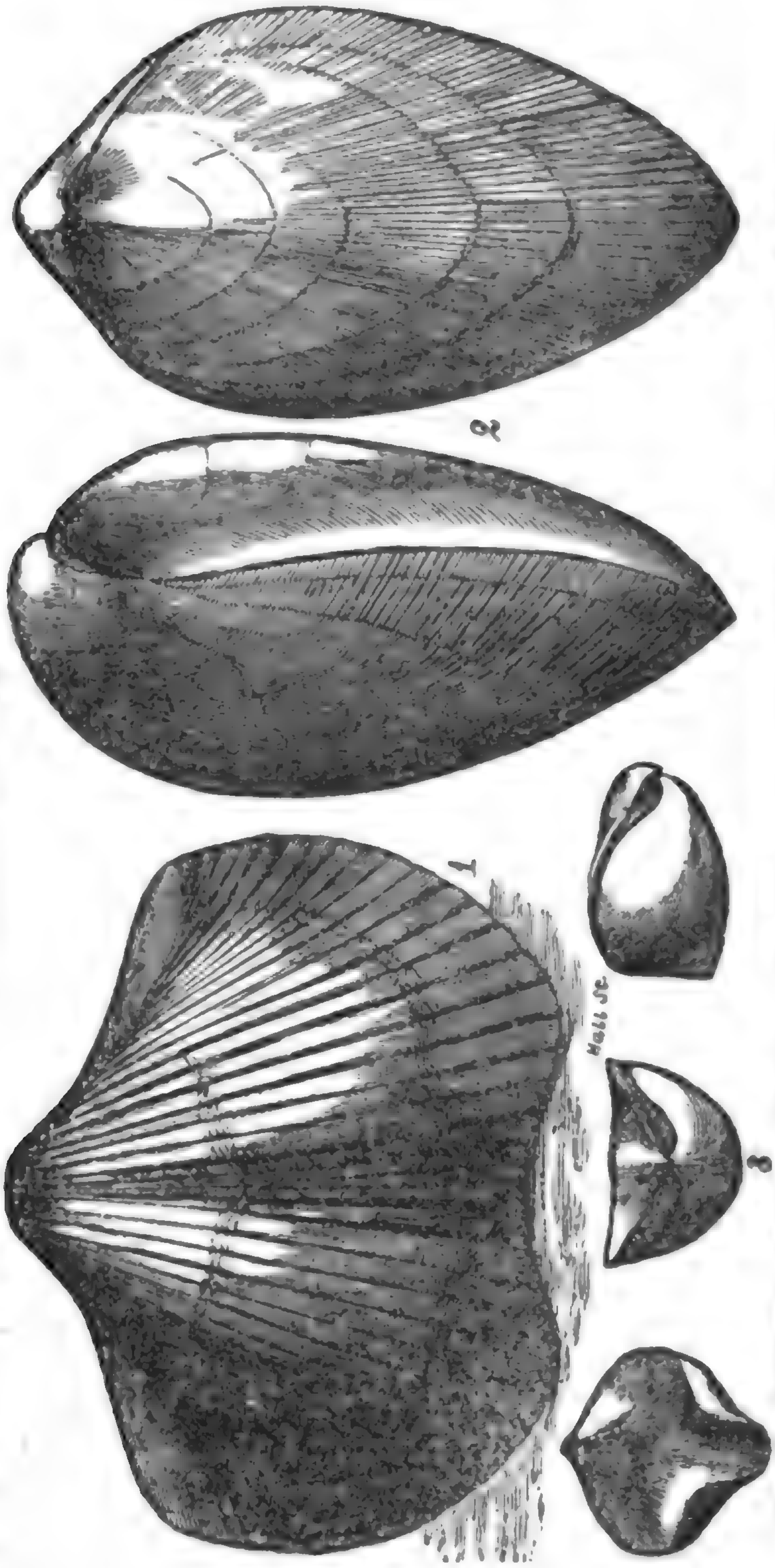
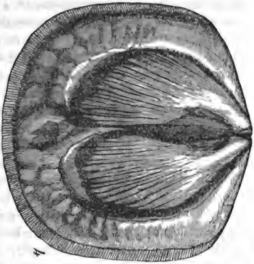


Fig. 1. *Delthyris arenosa*, Conrad. 2. *Atrypa elongata*, Conrad. 3. *Atrypa peculiaris*, Conrad.



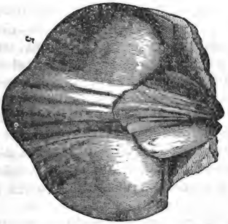


Fig. 4. *Atrypa unguiformis*, CONRAD. (*Hipparionyx proximus*, VANUXEM.) 5. Cast of *Delthyris arenosa*, fig. 1.

Vanuxem's Report, p. 134.

Casts are of more frequent occurrence than perfect fossil shells, as is apt to be the case both in sandstones and magnesian limestones. One of these, fig. 4, from its strong resemblance to a colt's foot, has been called by VANUXEM, *Hipparionyx proximus*, believing it to be a genus intermediate between the *Atrypa*, *Strophomena*, *Orthis* and *Pentamerus*.

None of these forms, as far as we know, have been discovered, either in the western U. S. or England. It is remarkable, however, seeing that no other rocks of like lithological character are found in the upper or middle part of the New York system, that there exists at the falls of Fall Creek, near the central part of the State of Indiana, apparently in an isolated position,* a fine grained, white and yellowish siliceous sandstone, evidently very similar to the Oriskany sandstone, and which cannot be far removed from the same geological horizon; yet, since this Fall Creek rock is particularly characterized by casts of *Pleurorhyncus*, (one of which is, probably, the *cuneatus*,) and postabdomens of a *Calymene*, that it is the western representative of the Schoharie grit. It is not at all improbable, however, that here are blended together the three adjacent siliceous formations of the Helderberg series,—the Oriskany sandstone, and overlying *Cauda-galli* and Schoharie grits; for we find that though the upper layers in which the *Pleurorhyncus* occurs, effervesce with acids, there is beneath a whiter variety, of quite a different appearance, destitute of calcareous matter, in which, as yet, no fossils have been observed.

The eastern shore of Cayuga is a good locality for collecting the fossils of the Oriskany sandstone.

The purer varieties of this rock are used in the manufacture of glass at Vernon. Some iron ore has been procured in the ferruginous layers near Perryville; but all that has hitherto been obtained, was found to be too much contaminated with sand to be of economical value, as is too often the case where hydrated oxide of iron has been infiltrated amongst sandstones.

Caudi-galli Grit.—This and the succeeding formation are of limited extent and of little importance; so that we shall pass them over with only a few remarks. The *Caudi-galli* grit is an argillo-calcareous sandstone, usually of a drab color or brownish hue, containing remarkable plumose impressions, supposed to be *Fucoides*, which have given name to the rock.

Schoharie Grit, is a calcareous sandstone, which, when weathered, becomes porous and colored with ferruginous stains. "It abounds in a species of *Pleurorhyncus* and *Orthoceras*, along with many corals, and is well developed at Schoharie and the Helderberg.

Besides the siliceo-calcareous, *Pleurorhyncus* rock above cited, as occurring in the middle of Indiana, there is a porous siliceous rock full of casts of corals found in the southern part of the same state, particularly near Vernon, in Jennings County, and on Racoon Creek, where it is quarried for millstones and sold under the name of the Racoon Creek burr; they are however, for the most part, too soft, owing to the presence of calcareous matter. This is, very likely, the western equivalent of the porous part of the Schoharie grit.

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* The extensive drift formation of this part of Indiana, renders it difficult to ascertain the area over which these siliceous rocks prevail.

Onondaga Limestone.—Though not exceeding ten or fourteen feet in thickness, this rock is wonderfully persistant. In consequence of the absence of the strata which intervene between it and the Onondaga salt group, through a great part of Western New York, this limestone often rests on the impure limestone, the terminal mass of the salt group, with sometimes a few inches of sandstone, or a band of non-fossiliferous bluish grey limestone intervening.

The Onondaga limestone is, for the most part, a pure calcareous rock, with thin partings of greenish shale between the beds, often made up of the fragments of *Crinoïdea* and corals, particularly species belonging to the genera *Cyathophyllum* and *Favosites.* These are not unfrequently of a pink or reddish color, which gives the rock a pretty variegated appearance, and renders it well suited for a marble. "When thinly laminated by these seams of shale, and the surface covered with encrinital columns and plates, as it usually is," Hall informs us, "the rock bears most striking resemblance to the Wenlock limestone of England, as seen in some specimens from Wenlock which were presented by Mr. Lyell. So complete is the resemblance in some instances, that one might almost be mistaken for the other. Judging, however, from the general character of specimens and the description of Mr. Murchison, there is a greater amount of shale intermixed with the Wenlock limestone, than with our rocks at the same period."

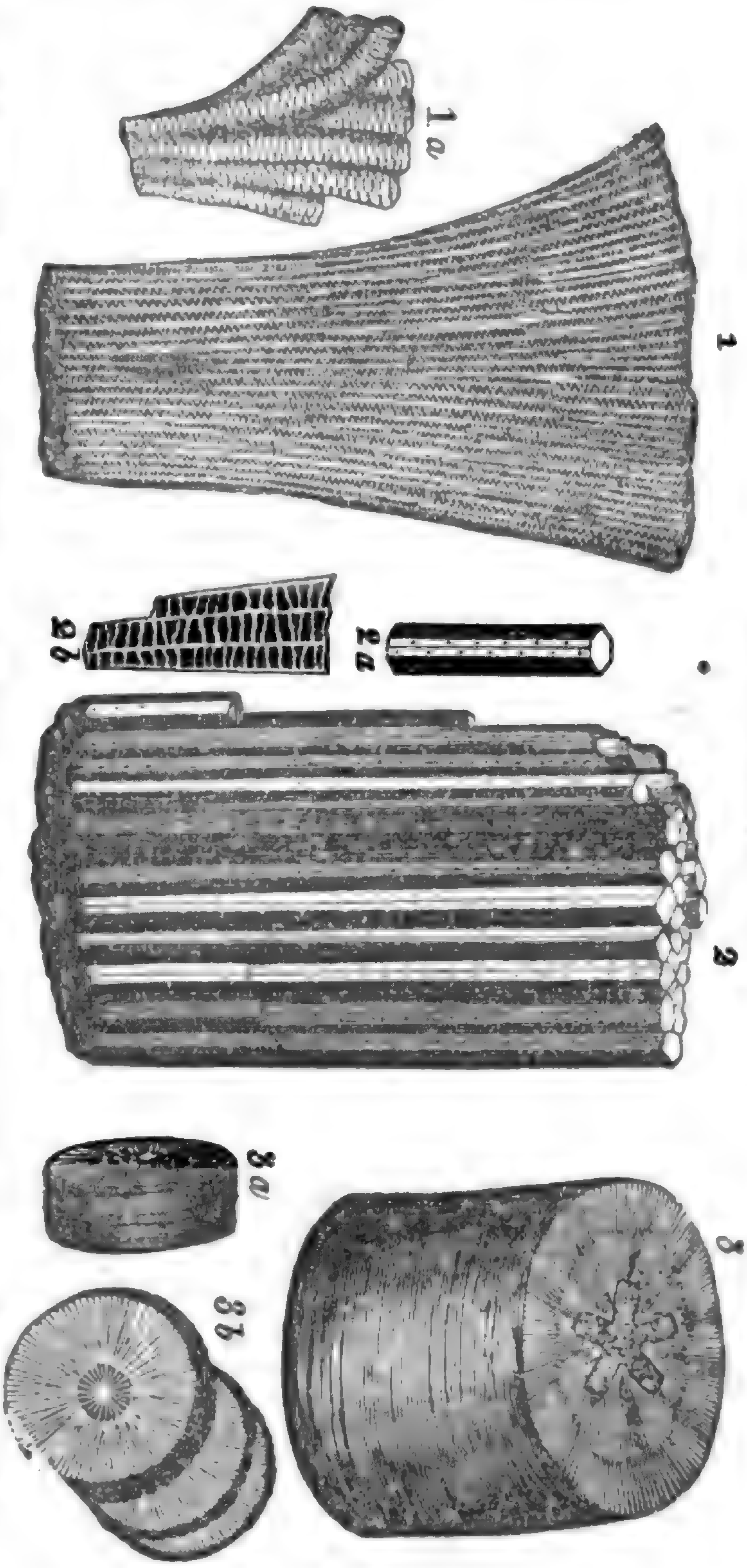
"The similarity or even identity of specimens from Dudley in England with those from the Niagara group, has been remarked; if this inference be correct, of which there seems no doubt, then we find a wide separation here between rocks which in England constitute one group. That such is the fact appears plain; for there are many fossils of the limestones above the salt group, which are identical with the Wenlock formation, while the identity of so many species of the Niagara group leaves no doubt of perfect correspondence. We are therefore to look upon the salt group as a formation, on this continent, coming in at a period during which, in England, the rocks are supposed to belong to a continuous group, or to be parts of one formation." (HALL's report, pp. 152, 153.)

This seems to be also the case in the Western States of North America; for, on comparing the eastern and western formations, it is difficult to say where the geological horizon lies in the West, that separates the beds representing the Niagara and Onondaga formations. Speaking of the former of these in a previous part of this Review, we expressed an opinion that the coralline beds of the vicinity of the Falls of the Ohio might be the equivalent of the Niagara group, but that, until more of the corals of this New York formation were described and figured, the absolute identity could not be established. We should have said, *part* of the coralline beds, instead of coralline beds; for we shall see, on comparing the corals of the Onondaga limestone with western fossils, that many of them are the same species which occur in these same coralline beds. The fact is, these strata probably admit, as Dr. CLAPP has suggested, of a twofold division into upper and lower beds; and a minute comparison of eastern and western specimens, will most likely prove the lower of these to be the equivalent of the Niagara group, whilst the upper represents the Onondaga limestone; the intervening salt group and Manlius water limestone having no western representative. The coralline beds of the magnesian limestones of the northwest, most probably belong to the lower or Niagara division.

The range of the Onondaga limestone is coëxtensive with the limits of the state, and is represented, together with the succeeding formation, on the chart by a light blue band, whose general course is nearly east and west to Schoharie, thence, with a southerly curve coincident with the Helderberg range, to the Mamakating Valley.

Well defined joints in two directions, are particularly characteristic of this formation, which admits of its being got out in very regular blocks. A fine example of this is seen at Split-rock quarry, southwest of Syracuse.

The large, smooth *Entrochites*, fig. 3, p. 59, provisionally called *Encrinites lævis*, is an exceedingly abundant fossil of the Onondaga limestone. The same encrinite "exists in prodigious numbers," according to VANUXEM, "ten miles north of Nashville, Tennessee. The following corals are also very common.



Hall's Report, p. 157.

Fig. 1 and 1a. *Favosites alveolaris.* 2. *F. Gothlandica.* 2a. A single tube magnified twice, and presenting a double row of pores upon the side. 2b. A fragment from a honey-comb specimen, showing the transverse lamellæ. 3, 3a and 3b. Fragments of crinoidal columns, showing the pentapetalous canal and crenulated edges of the plates.

Perhaps no protozoic fossil has a wider range than Fig. 2 of this illustration, *Favosites Gothlandica.* Not only does it occur in the limestones of Gothland, the Eifel and Groningen, as well as the magnesian limestones of Gerolstein in Europe, but also in the Wenlock limestones of England. In this country it is by no means confined to the State of New York, but is found in great perfection in the coralline beds in the vicinity of the Falls of the Ohio, in Kentucky, Tennessee and Indiana, and also in the magnesian limestone of the lead regions of Iowa and Wisconsin. Indeed every locality in the West where the middle protozoic strata reach the surface, seems to afford specimens of this columnar and honey-comb shaped coral. Lonsdale's remark, with regard to the identity of this species and the *Basaltica*, holds good also with regard to the structure it exhibits in the western country. On the same specimen, a single, double, or even triple row of pores may be observed; so that no specific distinction can be founded on the number of rows of pores on the partition walls.

Fig. 1 is also a western fossil; at least, Dr. Troost enumerates this species amongst corals found in Perry County, Tennessee, and the coralline beds near the Falls of the Ohio furnish a species apparently the same, though, in consequence of the difficulty of distinguishing the position of the pores in the specimens on hand, we cannot speak positively. The last mentioned locality in the West, as well as the magnesian limestones of the northwest of Illinois, near the lead region, afford fine specimens of the tuberose varieties of Fig. 1. (No. 62, p. 159, Hall's report.)

Hall's Report, p. 159.

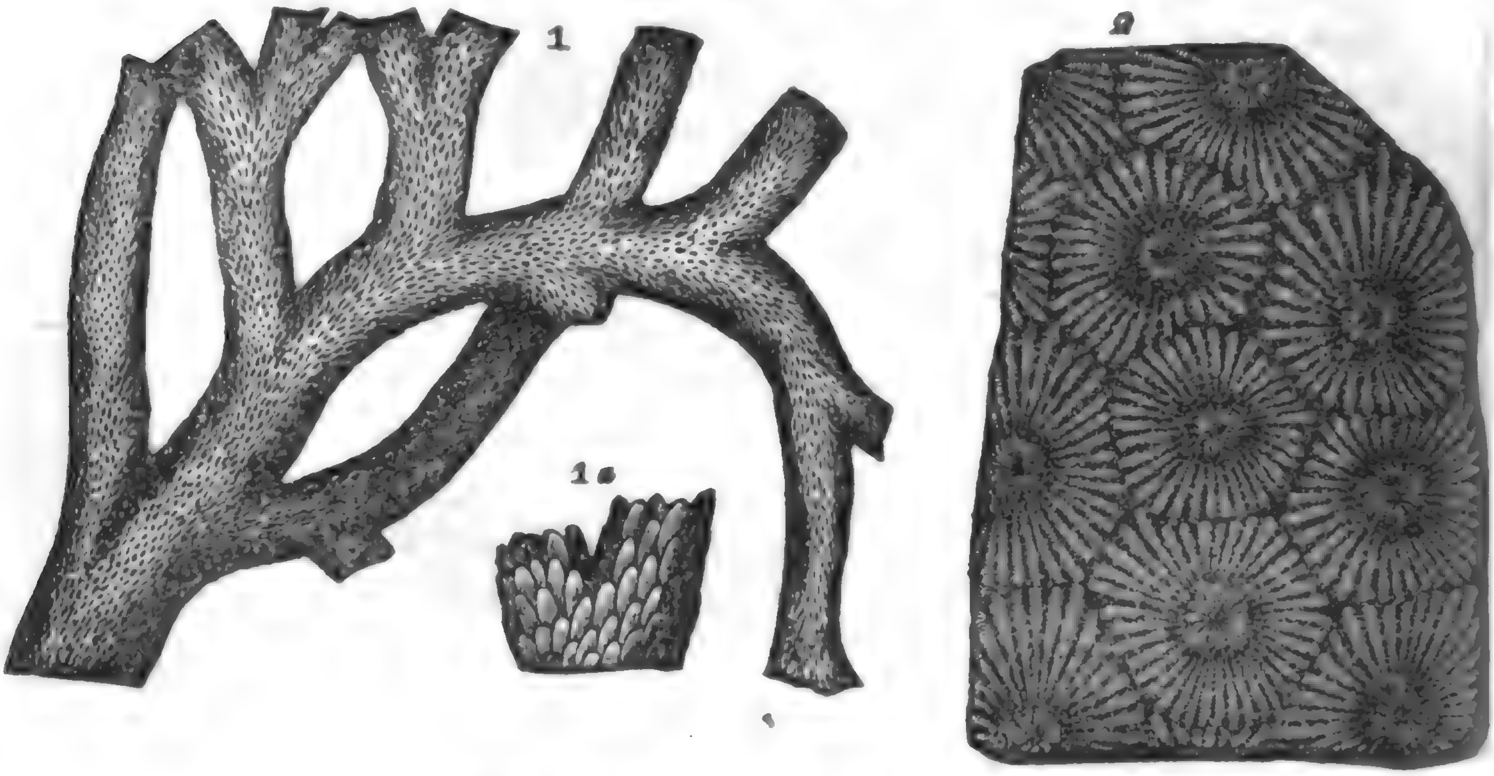


Fig. 1. *Favosites fibrosa?* 2. *Astrea rugosa.*

The limestone of Iowa City, (known as the Iowa City marble,) in the southwest part of the Du Buque district of Iowa, is almost made up of coral, the transverse section of which closely resembles Fig. 2 of the above wood cut, except that the stars are only about three twelfths of an inch across. The Iowa fossil is however not lamelliferous, but presents the appearance of long, irregular hexagonal columns, grouped close together after the manner of basaltic columns. A magnificent coral of snowy whiteness, of similar structure, with the prisms more than a foot long, and in masses weighing nearly a ton, was discovered many years ago at Charleston Landing, about eight miles above the Falls of the Ohio, in the coralline beds already referred to.

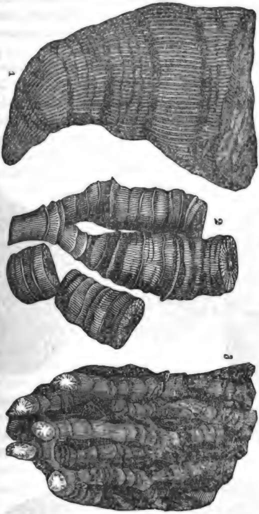


Fig. 1. *Cyathophyllum* —— ? 2. *Cyathophyllum dianthus.* 3. *Syringopora* —— ?

Hall's Report, p. 160.

Until the internal structure of Fig. 1 is described, it would be premature to decide upon its identity with fossils of other localities; but in its general form and external appearance it resembles a species found in abundance at Utica, a few miles above the Falls of the Ohio, and elsewhere in that vicinity. The same locality also furnishes specimens that are doubtless the same as Fig. 2.

On the Mississippi, a little below the mouth of Rock River, in limestone, probably an extension of the Iowa City rock, a coral abounds resembling Fig. 3, but the cylinders of which the group is composed are of larger size. We have been disposed to consider it *Cyathophyllum cæspitosum*, inasmuch as it shows no appearance of a syphon nor transverse connecting tubes.

Along with these are found *Cyathophyllum flexuosum*, and *C. ceratites;* hence EATON's name for this limestone, "ceratial rock."

Corals are far more numerous than shells in the Onondaga limestone; in VANUXEM's report, however, the following ***Testacea*** are figured, which we are informed are generally diffused in, and appear to be confined to this rock in the third district. They do not appear, however, to have a wide range beyond this region of the state.

Vanuxem's Report, p. 137.

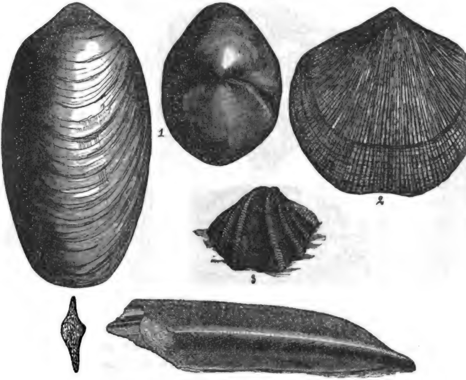


Fig. 1. *Pentamerus elongata.* 2. *Hipparionyx* (*Atrypa?*) *consimilaris.* 3. *Delthyris undulatus.*

In the shell strata on the Falls of the Ohio, there are vast numbers of *Delthyris*, which, in their general form, resemble Fig. 3 of this wood cut; but they are much smaller than this figure, and its ribs are finer and more numerous, (from sixteen to eighteen.) Dr. Clapp has called it *Delthyris gregaria.*

This is the lowest position in the State of New York, in which any remains have been found of animals higher in the scale of organized beings than *Crustacea*, with the exception of an imperfectly preserved fish-bone discovered by Hall in the Oriskany sandstone. That specimen, together with the defensive fin bone, Fig. 4, found in this part of the New York system, furnishes evidence of the existence of animals belonging to the class *Vertebrata*, during the deposition of the middle part of the protozoic strata. Besides these, Vanuxem mentions a gigantic species of *Cyathophyllum*, (*C. gigantea*,) as peculiar to this rock, some over eight inches long. On the Falls of the Ohio, *Cyathophylla* occur nearly as long as a man's arm, (*C. gigas* of Clapp.) Perhaps the western and eastern species may be found to be identical.

Conrad has also described and named the following fossils from the Onondaga limestone: *Asaphus aspectans*, *Delthyris raricostata*, *Strophomena gibbosa*, *S. perplana*, *Atrypa nasuta*, *A. unisulcata*, *A. acutiplicata*, *Avicula pecteniformis*, *Cypricardites inflata*, *Bellerophon curvilineatus*, *Pleurotomaria Poulsoni*, *P. unisulcata.*

The foregoing affords strong presumptive evidence that the upper coralline beds of the Falls of the Ohio are equivalent to the Onondaga limestone of New York. Since many more corals than have been described or enumerated occur in these formations, we shall be better able to judge of their parallelism after the publication of the volume on the palæontology of the State of New York. Dr. Troost's description of the fossil corals found in the limestone of Perry County, Tennessee, leaves little room to doubt that there, and at the locality of the *Encrinites lævis*, ten miles from Nashville, mentioned by Vanuxem, will be found their south western representative. Dr. Troost enumerates, amongst other fossils of that part of Tennessee, *Calamopora* (*favosites*) *favosa*, *basaltica*, *alveolaris* and *spongites*; besides several species of *Cyathophylla*.

The upper calcareous bed near the falls of Fall Creek, (Pendleton marble,) agrees in lithological character, external appearance, and geological position, with the Onondaga limestone; but we have, as yet, no evidence derived from organic remains.

Thus it would appear that the Onondaga limestone, though of no great thickness, has still a vast range both west and south, hundreds of miles beyond the limits of the State of New York.

At many localities, particularly in the vicinity of Cherry Valley, the rock in question receives a good polish and forms a handsome marble.

HALL suggests, what is highly probable, that the origin of this formation has been a coral reef; where it is thickest, he thinks the larger and more hardy species existed; where thinnest, the tender corals and *Crinoïdea* flourished in sheltered situations, most of which were, by the action of a troubled sea, overturned, broken down and scattered over the bed of the primeval ocean.

The best localities in the state for studying this formation and its organic remains, are, near Williamsville, on the farm of Mr. Youngs, in the town of Amherst, Erie County; in Clarence, in the same county; at the quarries of Le Roy, Genesee County; in Caledonia, west side of the Genesee, and at Vienna; on the road from Fort Plain to Cherry Valley, Otsego County; near Syracuse, Onondaga County; and at the falls of Perryville and Cazenovia. On the Helderberg Mountains, in Sharon, Bern and Bethlehem, are some of the best localities in the first district for collecting specimens of its fossil corals.

Speaking of its mineral contents, HALL says: "Crystallized carbonate of lime, quartz in crystals lining cavities, chalcedony and hornstone, with iron pyrites, are the only minerals noticed in this rock." Its thickness, the same author informs us, is very variable, being from one to twenty, or even forty feet; but VANUXEM says, it very rarely exceeds ten or fourteen feet.

Corniferous Limestone of EATON, (embracing the Seneca limestone.)—This name was given to the member of the New York system now to come under review, by EATON, in consequence of the number of flinty and hornstone nodules which it contains. These are arranged usually in layers something like flints in chalk, and accompany the rock, according to VANUXEM, throughout its entire range. It was not separated by EATON from the Onondaga limestone, both being included under this head; now they are separated into two formations, because each is found to contain a peculiar assemblage of fossils, besides differing in lithological aspect; for the corniferous limestone is more compact, of a finer grain, and contains many more flinty layers and nodules than the last described formation. Though mostly of light grey or bluish tints, the corniferous rock assumes, at some localities, especially at Black Rock, a very dark color. It is more persistent in its lithological character than the Onondaga limestone, and of greater thickness, varying from twenty to seventy feet.

Along with the last formation, it forms the upper calcareous terrace of the Helderberg range, and with the Onondaga salt group forms the second limestone terrace south of Lake Ontario in Hall's district.

Its range and outcrop are represented on the chart by the same blue band that marks the limits of the last formation which it immediately overlies, and with which it is coëxtensive, appearing, however, always as the thicker and more prominent member. These together with the previously described members of this division, have a southerly dip and pass under the Marcellus shale.

The corniferous limestone imparts to the scenery of a country where it prevails, a peculiar and constant feature; for "all the small streams as they pass over it, form rapids or cascades of more or less extent." It is the barrier at the outlet of Lake Erie, and the rapids at Black Rock are produced by the descent of the waters of the Niagara River over its beds.

Like the preceding, it often lies regularly jointed in the quarries. At Seneca there are dislocations of such a nature that seem to indicate an undermining; this has been attributed to the removal of the soft gypsum rock beneath.

Instead of the corals and *Crinoïdea* of the last formation, we find in the corniferous hardly any thing but shells. Hall is of opinion that about the time of the deposition of this rock, the bed of the ocean sunk beyond the influence of the light and the particular temperature favorable for the growth of *Polypariæ;* and by oscillations of the surface, the previously existing tribes of that order were overwhelmed and covered up by a calcareous mud.

The most fossiliferous part of this rock is the upper portion, when free from hornstone and chert. "Amongst these are two trilobites, the *Odontocephalus selenurus* of Green, Fig. 1, Pl. 33, (Vanuxem's report,) and a *Calymene.* So abundant is the former of these at Schoharie and other places, that it alone is the fossil entirely relied on, and the rock is known as the 'Selenurus rock.' The other trilobite is scarcely less characteristic. In many places in the third district, and in Seneca County in the fourth district, the *Strophomena lineata* of CONRAD is the typical fossil, but it rarely occurs at any point west of the last named locality."*

Some of the most abundant fossils of Western New York, figured in HALL's report, are given below.

Hall's Report, p. 171.

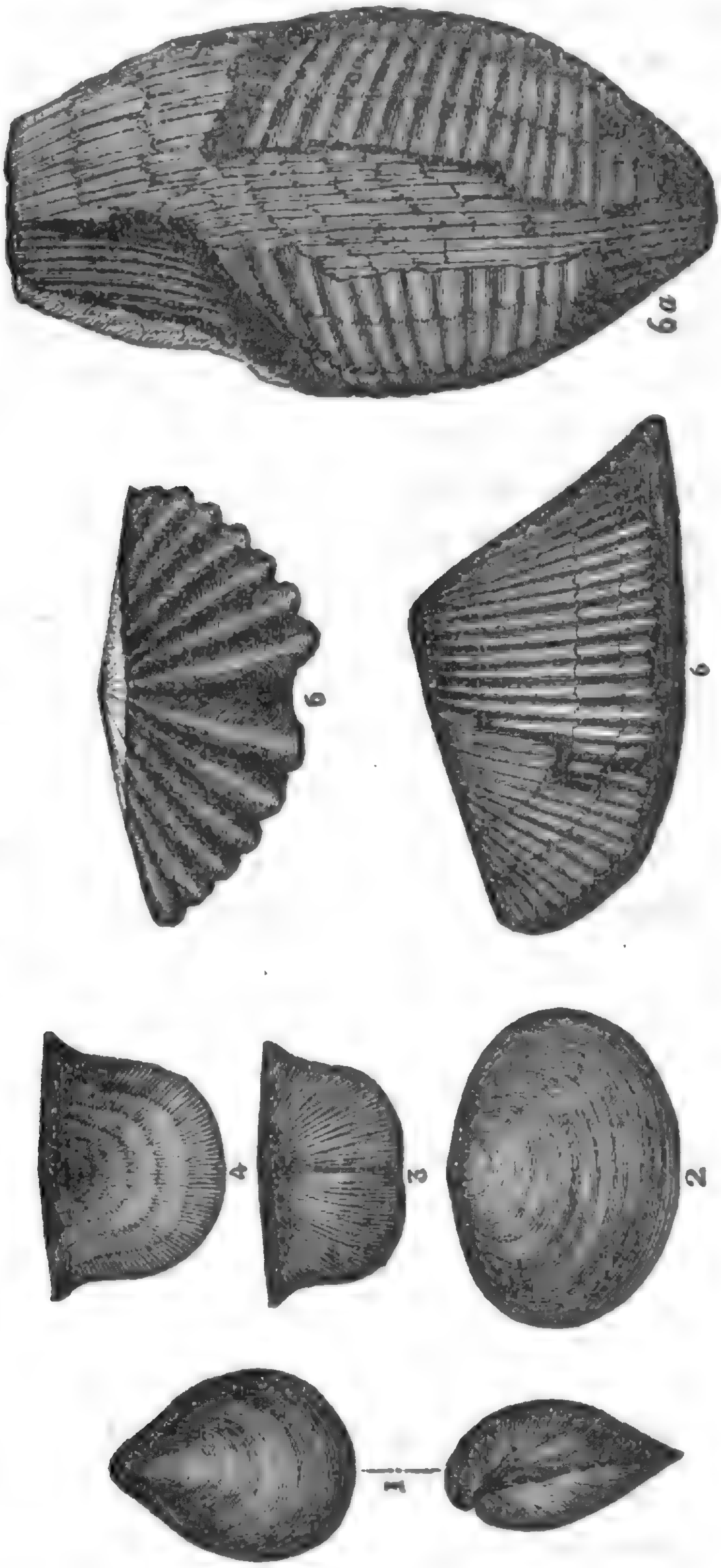


Fig. 1. *Atrypa scitula*, H. 2. *Paracyclas elliptica*, (like *Cyclas*.) 3. *Strophomena acutiradiata*, H. 4. *Strophomena crenistria*, H. 5. *Delthyris duodenaria*, H. 6. *Pleurorhyncus trigonalis*, H.

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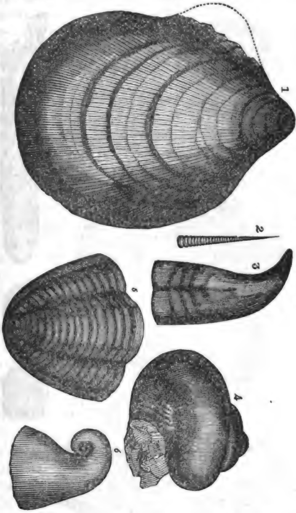
* Hall's report, p. 170.

Of these the *Pleurorhyncus*, fig. 5, has probably the widest range; at least there is a *Pleurorhyncus* found in the shell strata of the Falls of the Ohio, which bears a strong resemblance to this figure. The principal difference is, that the full grown western species seems to have a greater number of ribs than the eastern, fig. 25. There are other shells in the same rock of a type analogous to figs. 2 and 4, but the specific identity cannot at present be established.

In the report of the fourth district, the following characteristic fossils occur in the rock at Williamsville, Erie County.

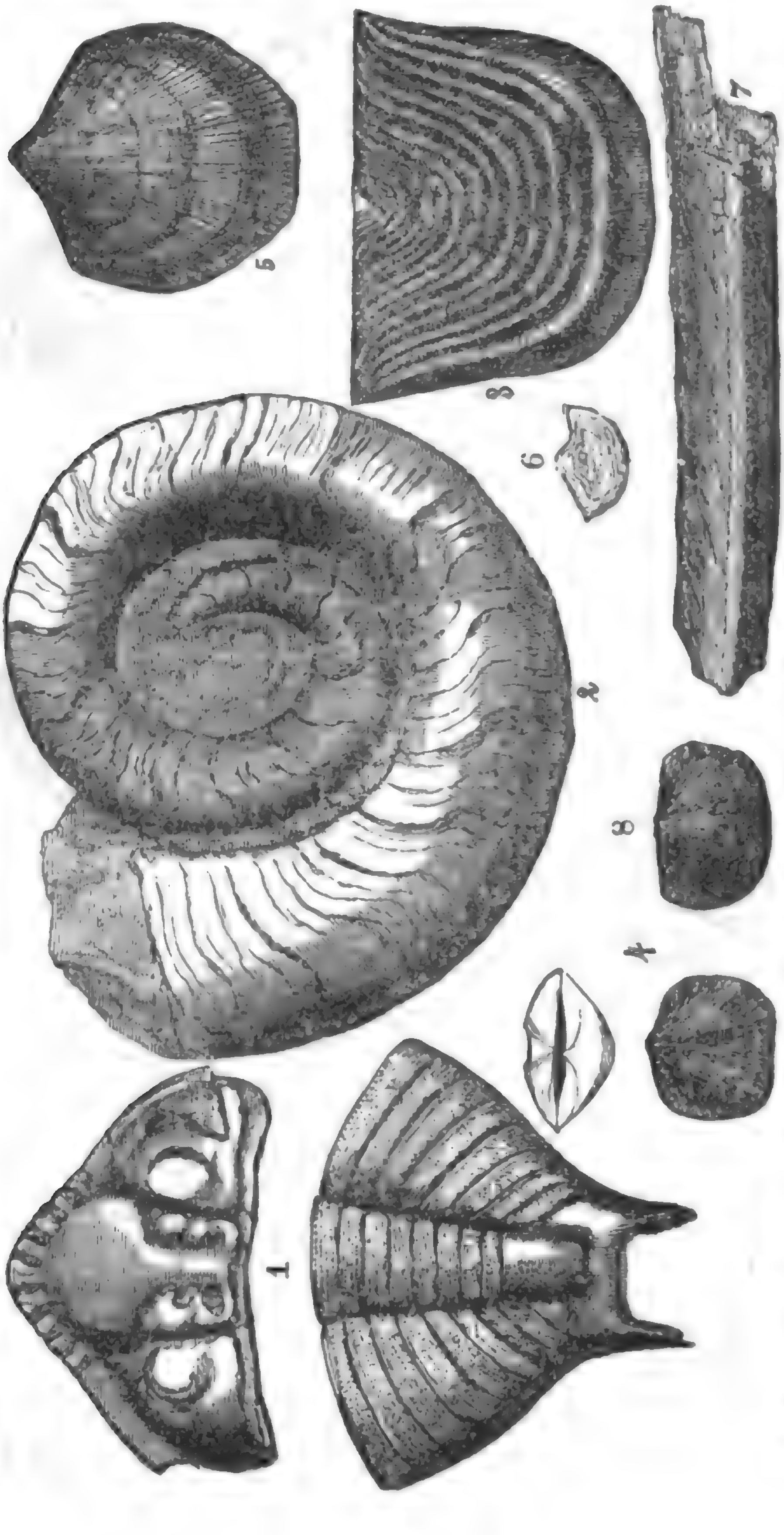


Hall's Report, p. 172.

Fig. 1. *Pterinea* (?) *cardiiformis*, H. 2. *Tentaculites scalaris*, Schlot. S. R. 3. *Orthonychea*, a new genus, from its resemblance to a claw or talon. 4. *Euomphalus* (?) *rotundus*. 5. *Calymene crassimarginata*. 6. *Acrocula erecta*.

Figs. 4 and 5 are identical with specimens in our possession from the shell strata of the Falls. Fig. 2 is supposed to be of the same species as one which is abundant both in the Caradoc formation of England, and the Hudson River group of New York. The Ludlow formation of England, affords a species which MURCHISON informs us, cannot be distinguished from that of the Caradoc. The blue limestone of Cincinnati contains a *tentaculites*, but the specimens on hand are not sufficiently distinct to enable one to decide on specific identity. Dr. CLAPP has found a *tentaculites* in the water limestone, but he supposes it to be a new species.

The figures given by VANUXEM as most abundant in the corniferous limestone in his district, are the following:



Vanuxem's Report.

Fig. 1. *Odontocephalus selenurus*, CONRAD. 2. *Cyrtoceras undulatus*, VANUXEM. 3. *Strophomena undulata*. 4. *Orthis lentiformis*. 5. *Atrypa prisca*. 6 and 7. *Ichthyodorulite*. 8. *Strophomena lineata*, CONRAD.

Fig 5 is the only one of these which we know has been found West; it occurs in great abundance in the shell strata of the Falls of the Ohio, and, at some localities, is common also in the water limestone above; in fact it is by far the most conspicuous fossil in both these rocks. Speaking of the organic remains of the corniferous limestone in the vicinity of Williamsville and several points between that place and Buffalo, HALL remarks: "It is particularly interesting from containing numerous fossils of the genera *Strophomena*, *Delthyris* and *Pleurorhyncus*;" if he had added *Atrypa*, this observation would have been equally applicable to the shell strata on the Falls of the Ohio.* All this goes to show, almost conclusively, that these shell beds, the western water limestone, and the corniferous rock, were deposited at the same period of time; the more especially since they are overlaid, at both localities, by a black bituminous shale so different from the underlying members of the middle division of the New York system.

There are numerous localities where the corniferous limestone can be studied: we may mention particularly the quarries in Seneca County, the bed of Flint Creek at Vienna, the outlet of Canandaigua Lake, and the bed of Mud Creek. At the village of West Mendon, near the village of Caledonia, and between this and Le Roy, the strata are well exhibited, but few fossils occur. At Clarence Hollow, this rock contains a few fossils not elsewhere seen.

In consequence of the fissured, or rather disjointed state of the beds constituting this rock formation, water often percolates to a considerable depth before it reaches an impervious stratum; there accumulating, it at length flows out some distance down the northern outcrop in copious and refreshing springs, imparting verdure and beauty to the scene beneath, which forms a striking contrast to the arid and barren ledges above. Streams, too, often disappear in the vacant spaces of the creviced rock. From the same cause, the vegetation over the limestone is more vigorous immediately above the cracks of the rock than elsewhere, owing to the moisture beneath rising by evaporation and capillary attraction to the rootlets of the overgrowing plants.

"Few simple minerals present themselves in this formation; hornstone sometimes passes into chalcedony, and crystallized quartz is rarely found. In its cavities at Black Rock, dog-tooth spar sometimes occurs; at the same place, fluid bitumen or petroleum is found, usually filling the cells of the *Favosites.*"

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* In a crystalline layer of limestone interposed between the shell stratum and the water limestone, we found a *Conularia* which seems to be the same species as the *quadrisulcatus* of the Wenlock limestone.

The upper coralline beds of the Falls of the Ohio, include a "black stratum," containing many corals; this is, in all probability, the western representative of these dark colored beds at Black Rock.

With the Seneca limestone, the uppermost bed of the corniferous formation, terminates upwards the Helderberg series of the geographical division; so also is it the last member, in the ascending scale, of the the transition series between the middle and upper division, according to the chronological scale. Here also is the close of all the important *limestones* of the New York system, for the calcareous deposites above are but thin and local in their extent. D. D. O.

(*To be continued.*)

ART. VI.—*Musci Alleghanienses, sive Spicilegia Muscorum atque Hepaticarum quos in itinere a Marylandia usque ad Georgiam per tractus montium A. D.* MDCCCXLIII, *decerpserunt* ASA GRAY *et* W. S. SULLIVANT: (*interjectis nonnullis aliunde collectis:*) *Concinnavit et exposuit* W. S. SULLIVANT. Fascis I, II. Columbus in Ohione, MDCCCXLV.

THIS beautiful *publication*, as it may be justly called, although not intended for sale, consists of about fifty presentation copies, or sets of the specimens themselves, with printed labels, title-pages, and index, prepared at no small labor and expense, and in an unusually elegant style, for distribution among the principal muscologists abroad, and those most interested in these pursuits at home. A *work* it may with literal propriety be termed, since, beside the labor of collection, of which the writer may speak from some actual knowledge, the manual preparation, arrangement, and critical study of the materials, with the subsequent journeys that have been required for the sake of rendering certain portions more complete, have fully occupied all the zealous author's available time for the two years which have elapsed since the plants were gathered.

The collection fills two large quarto volumes, and comprises 215 species or marked varieties of true Mosses, and 77 of Hepaticæ,—in all 292. We should render a service to this beautiful and too much neglected department of American botany by copying the whole list: we will at least find room for the new species which are here proposed and characterized; since the work must, from the necessity of the case, have but a limited circulation, and may fail to reach many who are interested in the subject. In these instances we copy the original tickets entire, with the numbers under which they appear, as follows.

7. HYPNUM PALUDOSUM (*n. sp.*).

Dioicum; caule procumbente flexuoso radiculoso-tomentoso diviso, divisionibus elongatis ascendentibus simpliciter pinnatis; ramulis compressiusculis; foliis cordato-lanceolatis acuminatis erecto-patentibus plicatis margine reflexis costa ad apicem evanida carinatis.

Medium inter *H. Blandovii* et *H. plicatum.*

HAB. in editoribus Ohionis septentrionalis paludibus *Cranberry Marshes* dictis.

62. LESKEA DENTICULATA (*n. sp.*).

Caule repente fastigiato-ramoso; ramis erectis confertis compressiusculis; foliis dense imbricatis subsecundis ovatis subito longeque acuminatis ecostatis concavis denticulatis rhomboideo-areolatis; capsula ovali-oblonga, operculo oblique rostellato.—Pterogonium filiforme, var.? HOOK. et WILS.! *in Drumm. Musc. Amer. n.* 86.

HAB. ad arbores in jugo excelso *Balsam Mountain* dicto, Carolinæ Superioris.

89. LEPTODON OHIŒNSE (*n. sp.*).

Caule repente; ramis julaceis vage ramosis; foliis dense imbricatis madore horizontaliter patentibus costa valida ultra medium abrupte desinente instructis: cætera, excepta statura minore, *L. trichomitrii.*

HAB. circa urbem *Columbus* in Ohione; rarum.

170. SYRRHOPODON? EXCELSUS (*n. sp.*).

Densissme cæspitosum, fastigiato-ramosum; ramis corpusculorum (fl. abortiv.) congestis acervulis terminatis; foliis lineari-

subulatis convoluto-canaliculatis ecostatis subsecundis nitidis albido-viridibus, e compluribus stratis tubulosarum cellularum formatis. . . . . .

Hab. in sylvaticis depressis inter montes Alleghanienses, ad arborum truncos putredine decompositos; necnon in Ohione haud infrequens, at semper sterile. Beat. T. G. Lea, scrutator muscorum in vicinia urbis *Cincinnati* indefessus primum detexit.

176. Trichostomum vaginans (*n. sp.*).

Dioicum, innovando-ramosum; ramis erecto-flexuosis gracilibus; foliis erecto-adpressis ovato-lanceolatis, perichæthialibus longe vaginantibus apice subito attenuatis patentibus costa valida excurrente instructis, areolatione mediocri; capsula ovali-oblonga; operculo longe obtusque conico; dentibus peristomii breviusculi binatim inter se anastomosantibus; membrana basilari haud emergente; annulo speciosissimo; flore masculo terminali; antheridiis elongatis paraphysatis.—*T. pusillum*, Hook. et Wils. *in Drumm. Musc. Amer. No.* 60 *et* 61.

Hab. in terra argillacea ad loca *Swananoa Gap* et *Hickory-Nut Gap* dicta, in Carolina Superiore.

182. Fissidens exiguus (*n. sp.*).

Annuus, dioicus; caule simplici; foliis 5–9-jugis oblongo-lanceolatis immarginatis integerrimis, costa ab apicem dissoluta; capsula terminali subobliqua vel erecta; operculo conico-rostellato; calyptra cuculliformi; flore masculo terminali.

Hab. in sylvis, ad rivulorum exsiccatorum lapides, prope *Columbus* Ohionis copiosissimus.

183. Fissidens minutulus (*n. sp.*).

Annuus, dioicus; floribus terminalibus; caule simplici; foliis 5–12-jugis, superioribus lineari-lanceolatis margine limbo subrepando haud incrassato plus minus circumdatis; costa sub apice evanida; capsula erecta ovali; operculo elongati-conico; calyptra cuculliformi.

Hab. iisdem in locis cum præcedente, rarius.

201. Sphagnum strictum (*n. sp.*).

Caule erecto subsimplici rigidiusculo; ramulis 4–5–natim fasciculatis, duobus æqualibus strictis obtusis horizontaliter patentibus, reliquiis deflexis, fasciculis confertis; foliis oblongo-acuminatis recurvis apice eroso 6–9–dentatis.

Hab. in montibus Carolinæ Superioris, ad scopulum mirabilem *Devil's Court House* dictum.

204. SPHAGNUM TABULARE (*n. sp.*).

Pusillum; caule erecto; ramulis substrictis æqualibus 3–4–natim fasciculatis; fasciculis approximatis; foliis ovato-lanceolatis reflexiusculis apice truncato 3–5–denticulatis.

Hab. in locis irriguis ad cacumen scopuli *Table Mountain* dicti, Carolinæ Septentrionalis, altitudine circ. 2500 ped.

205. SPHAGNUM MOLLE (*n. sp.*).

Tenellum, dense cæpitosum; caule erecto subindiviso; ramulis erecto-patentibus confertissimis indistincte fasciculatis; foliis oblongo-ovatis apice eroso-3–5–denticulatis.

Hab. in eodem loco ac No. 201.

221. PLAGIOCHILA MACROSTOMA (*n. sp.*).

Amphigastriis parvis subulato-bifidis, aut nullis; perianthio obconico ore compresso: cætera *P. interruptæ*, cujus forsan sit insignis varietas.

Hab. in ligno putrido humique circa Columbus Ohionis, rarissima.

222. PLAGIOCHILA UNDATA (*n. sp.*).

Caule repente; ramis adscendentibus simpliciusculis rigidulis; foliis arcte imbricatis horizontaliter divergentibus subhomomallis semicordatis apice obtusis vel emarginatis ibidemque parce dentatis, margine dorsali reflexa integerrima, ventrali basique in cristam reflexa repando-undulata; amphigastriis linearibus bipartitis dentatis.

Hab. in rupibus humo tectis ad flumen *Savannah*, prope Augustam Georgiæ.

223. PLAGIOCHILA LUDOVICIANA (*n. sp.*).

Caule repente; ramis adscendentibus parce ramosis flexuosis; foliis imbricatis patenti-divergentibus dimidiato-ovatis apice sub-emarginato-bi-tridentatis basi subtus in cristam conniventibus margine dorsali reflexis integerrimis, reliquo ambitu spinuloso-dentatis; amphigastriis profunde bi-trifidis, laciniis linearibus ciliato-dentatis; flore fœmineo terminali.—*Jungermannia spinulosa*, Hook. et Wils! *in Drumm. Musc. Amer.* No. 160.

Hab. ad cortice arborum in Ludovicia et Alabama.

270. Frullania Caroliniana (*n. sp.*).

Caule repente irregulariter bi-tripinnato; foliis dense imbricatis ovali-rotundis, auriculis parvis elongatis a caule distantibus, plica styliformi interjecta; amphigastriis ovato-rotundis caule duplo latioribus bifidis, laciniis subrepandis; perianthio compresso-pyriformi ventre obtuso carinato.

Hab. in cortice arborum prope Wilmington, Carolinæ Septentrionalis.

286. Marchantia disjuncta (*n. sp.*).

Dioica; receptaculo fœmineo excentrico subsepteno-radiato, radiis apice cuneato-dilatatis emarginato-crenulatis subtus dense barbatis; involucro mono-tricarpo subintegerrimo; receptaculo masculo semicirculari 7-radiato, radiis usque ad brevem pedunculum discretis; fronde dichotoma et articulatim innovante: cætera *Marchantiæ polymorphæ.*

Hab. ad ripas præruptas fluminis *Alabama* prope *Clairborne.*

And finally we have a newly characterized genus, which is however equivalent to a badly described one established by the late Mr. Schweinitz, under a name already preöccupied.

NOTOTHYLAS, *Sulliv.*

Carpobolus, Schweinitz *in Jour. Acad. Nat. Sci. Philad.*, 2 *p.* 336 (1822). *Targioniæ spec.* Schweinitz, *Hepat. Am. Sept. p.* 23. *N. ab E. Europ. Leberm.* 4, *p.* 317.

Monoica. Fructus dorsales sparsi. *Involucrum* sessile, frondi continuum initio clausum, tandem superne fatiscens. *Perianthium nullum. Calyptra* . . . . . *Capsula* involucro inclusa, oblongo-sphæroidea, compressa vel ovato-cylindrica, brevissime pedicellata, pedicello in bulbo incrassato affixo, sutura longitudinali ab apice ad medium subbivalvatim vel (sutura deficiente) frustulatim dehiscens. *Columella* linearis. *Sporæ* quaternatim aggregatæ, subglobosæ, læviusculæ. *Antheridia* frondi immersa, elliptico-globosa. Frons orbicularis, laciniata, tenera, papuloso-reticulata, margine undulato-crispa, subtus radiculosa, massis granulatis hic illic immersis.

Plantæ annuæ, terrestres, limicolæ, in umbrosis Ohionis Carolinæque Septentrionalis observatæ.

289. NOTOTHYLAS VALVATA (*n. sp.*).

Fronde diametro 3–8–lineari; involucro horizontali deflexo corniformi; capsula elongato-cylindrica curvula sutura colorata semper instructa; sporis luteolis subfuscisve.

HAB. in humidiusculis circa Columbus Ohionis sat frequens.—Maturescit Æstate—Autumno.

290. NOTOTHYLAS MELANOSPORA (*n. sp.*).

Capsula sutura omnino nulla; columella appendiculata; sporis atro-fuscis dimidio majoribus quam in præcedente: cæteris conveniunt.

HAB. iisdem in locis cum priore, rarissima.

Spec. adject. NOTOTHYLAS ORBICULARIS, *Sulliv. l. c.*

Involucro suberecto; capsula oblongo-ellipsoidea compressa cum vel absque sutura concolori: cætera ut in *N. valvata.*—Carpobolus orbicularis, *Schweinitz*, *l. c.* (Diagnosis secundum specimina *Schweinitziana* in *herb. Acad. Nat. Sci. Philad.*)

The collection also embraces many re-discoveries of no little interest, as well as brief critical remarks and rectifications of synonomy which will be valued by the muscologist. We note some of the points that strike us as we turn over the pages.

No. 2 is *Hypnum umbratum* of EHRHART, collected on the Grandfather Mountain, and also since communicated by Mr. OAKES from the White Mountains of New Hampshire. It is here for the first time recorded as an American species. No. 48, *H. demissum* of WILSON, also from the rich sides of the rugged Grandfather, is equally new to America, and in fact is quite a recent discovery in Europe. No. 5, *H. gracile*, was intended as one of the new species of this work, but its publication has been anticipated by BRUCH and SCHIMPER. No. 6, *H. scitum*, is doubtfully referred to that species of BEAUVOIS. If the reference prove

to be wrong, it must bear the name of *H. intertextum*, Muhl. Cat., which name Mr. SULLIVANT has authenticated by the inspection of the remains of the Muhlenbergian herbarium. No. 9, *H. alopecurum*, LINN.; to this Mr. SULLIVANT refers the *H. neckeroides* of HOOKER. Under No. 11, *H. strigosum*, HOFFM., two nominal species are reduced, namely, *H. attenuatum*, BRIDEL, described from Torreyan specimens, and *Leskea fasciculosa*, HEDW., furnished by MUHLENBERG. The synonomy of No. 14, *H. Haldanianum*, GREV., is for the first time set in order. It includes not only *H. curvirostrum* of BRIDEL, but also *H. pulchrum* of DRUMMOND, and *H. Cooleyanum* of SPRENGEL. No. 15, *H. suberectifolium*, BRIDEL, has not until now been heard of since it was detected by Bosc. No. 17, *H. recurvans*, SCHWÆGR., is a re-discovery of one of MICHAUX's mosses; and No. 19, *H. reptile*, is another species of MICHAUX. No. 20, *H. pratense*, KOCH., is very little known, except by its occurrence by mistake in some of the copies of DRUMMOND's Northern Mosses, under his *H. amœnum*. To No. 30, *H. varium*, BEAUV., a fine set of synonyms, too numerous to mention, are reduced; and it is hinted that perhaps the whole should be referred to *H. serpens;* which would be in accordance with the views of that acute botanist, Mr. ARNOTT. No. 31, *H. confervoides*, BRID., no doubt the same as the Pennsylvanian plant mentioned by SCHWÆGRICHEN, is perhaps distinct from the original European species. To No. 46, *H. riparioides*, HEDW., the *H. prolixum* of MICHAUX is referred. No. 50, *H. deplanatum*, SCHIMPER, Mss., seems to be a common moss, though as yet it is undescribed. To No. 57, *H. confertum*, DICKS., are reduced *H. serrulatum*, from MUHLENBERG, (which was previously suspected,) and *H. cupressetorum*, furnished to BRIDEL by TORREY. The specimens of No. 58, the pretty *Hookeria lucens*, were the first detected in the United States, but we believe Mr. SULLIVANT has quite recently found it in Ohio also.

No. 60 is published as a marked variety of *Leskea polyantha*, HEDW.; but it is very likely a new species. No. 64, *L. compressa*, is a re-discovery of a moss which HEDWIG received from MUHLENBERG. The ticket of No. 65, *L. adnata*, MICHAUX, is crowded with interesting synonomy, the result of acute research. To No. 68, *L. obscura*, HEDW., the *L. gracilescens* is referred, from actual examination of the original specimens of MUHLENBERG. No. 69, *L. nervosa*, is the *Pterogonium nervosum* of SCHWÆG-

RICHEN, &c., here removed to *Leskea*. No. 70, *L. flaccida*, is a re-discovery of a well marked species sent to BRIDEL by TORREY. No. 71, *L. fragilis*, HOOK. and WILS., which has a range from Montreal to New Orleans, is still distributed without fruit, which is a great desideratum. To No. 72, *L. intricatula*, HEDW., a goodly number of nominal species are referred.

No. 79, *Neckera breviseta* of HOOKER and WILSON, is deemed by Mr. SULLIVANT to be much more nearly allied to *N. Cladorrhizans*, than to the species with which these authors compare it.

To No. 80, *Clasmatodon pusillus*, HOOK. and WILS., Mr. SULLIVANT refers with some doubt the *Leskea parvula* of HAMPE, and also *Pterigynandrum marginatum* of MICHAUX; if incorrectly, then this species of MICHAUX still remains to be identified.

No. 81, *Cryphæa filiformis*, BRID., which is very common in the Southern States, is said to have spores four times larger than those of *Daltonia heteromalla*.

No. 82, *Anacamptodon splachnoides*, BRID. Mr. SULLIVANT has discovered that the genus *Campylodontium* of SCHWÆGRICHEN was founded on specimens of this moss, which had lost their opercula and inner peristome! (Cf. *Schwægr. Suppl. t.* 52, *cum t.* 211.)

No. 84, *Pterigynandrum intricatum*, HEDW., has as a synonym the *Pylaisæa heteromalla*, BR. and SCHIMP., which these authors detected in DRUMMOND's Northern Mosses, (given by mistake as *Hypnum polyanthum*,) but did not recognize. The *P. julacerem*, HEDW., here becomes No. 87, *Leucodon julaceus*.

No. 88, *Leptodon trichomitrion*, MOHR., is distinguished from the new species that follows it by "statura majore, ramis pinnatim ramosis, foliis humectatis erecto-patentibus ecostatis." SULLIV. *mss.*

No. 92, *Mnium affine*, var. *minor*, is the *M. Drummondii*, BR. and SCHIMP.

No. 115, *Pogonatum capillare*, BRID., the *Polytrichum capillare* of MICHAUX, is kept separate from *P. urnigerum*, and additional characters are given for distinguishing it. The specimens are from the White Mountains of New Hampshire.

No. 135, *Ptychomitrium pusillum*, BR. and SCHIMP., has some important synonyms for the first time referred to it, viz. *Grimmia incurva*, MUHL., *G. Muhlenbergi*, BRID., *G. Hookeri*, DRUMMOND, and *Notarisia Virginica*, HAMPE.

No. 139, *Grimmia conferta*, Funck, now first recorded as an American moss, was collected on the White Mountains of New Hampshire by the indefatigable Mr. Oakes.

No. 159, *Dicranum fulvum*, Hook., is a rare species; and 167, *D. cerviculatum*, Hedw., (Hoboken, New Jersey, Torrey,) here first appears as an American moss.

Besides the two new species of *Fissidens*, the No. 180, *F. hyalinus*, Wils. and Hook., and No. 181, *F. obtusifolius*, Wils., and also the rare *F. grandifolius* from Niagara, No. 186, are here for the first time distributed. But perhaps the most interesting moss in the collection, is the *Phyllogonium Norwegicum*, Brid., No. 108, which is found at Lancaster, Ohio, with female flowers, but, although closely watched for some years, it has not been known to produce the fruit.

The *Fontinalis disticha*, Hook. and Wils., is given under three forms, (No. 190–192,) which it is thought will sustain the species.

No. 196, *Physcomitrium sphæricum*, Br. and Schimp., var. *insignis*, capsula immersa foliis serratis, is very likely a new species.

No. 198, the curious *Schistidium serratum*, Hook. and Wils., is here provided with the following character: Annum, monoicum; flore masculo fœmino approximato nudo vel 1–2–3–phyllo in foliorum axillis comalium sessili; antheridiis 4–12; paraphysibus apice globoso-distentis.—Habitu, foliis, calyptra ut et florum situ structuraque *Phasco patenti* omnino simile, diversum tamen capsula operculata et pachyderma; hic ad *Physcomitrium*, illic ad *Pottiam* accedit.—The characters of the masculine flowers, as here indicated for this plant and the closely allied *Phascum patens*, are important, since their structure and position have been entirely misapprehended by Hedwig, Bruch and Schimper, and all former observers, who say that they are borne on proper branches arising from the base of the main stem, that there are no paraphyses, &c.

No. 207, *Sphagnum macrophyllum*, Brid., is a most remarkable species, as well in habit as in the absence of spiral-threaded cells. No. 208, *S. sedoides*, Brid., is a re-discovery of a plant found long since by La Pylaie in Newfoundland. Dr. Torrey recently brought it from Mount Marcy in Northern New York. These are the only localities known, except the moist top of that singular natural tower, *Table Rock*, South Carolina, which is completely edged with it. Its slender prostrate stems may be procured a foot or so in length.

No. 214, ***Andræa Rothii***, is here first published as an American moss; but we believe that Schweinitz had found it in the mountains of Virginia.

Passing to the *Hepaticæ*, No. 220, *Plagiochila porelloides*, Lindenb., is here first made known in fruit, and with amphigastria, which had been overlooked. The proposed new species of the genus we have already given. No. 227, *Jungermannia Taylori*, Hook., collected by Mr. Oakes in New England, is here first enumerated as American. No. 260, ***Radula complanata***, var.? sive n. sp.? and No. 261, ***R. pallens***, are in the same case. No. 271, ***Frullania Hutchinsiæ***, var. foliis subintegerrimis, is a striking variety of a very rare plant, not before found out of Ireland. It was detected in moist rocks at the Mountain Cataract of Pigeon River Falls, along with ***Hookeria lucens*** and (on the dried summits of the rocks) ***Andræa Rothii***. No. 274, ***Lejeunia cucullata***, N. ab E., 275, ***L. calcarea***, N. ab E., and 276, ***L. minutissima***, Dumort., are likewise new to North America. Nos. 289, 290, *Notothylas*; this interesting genus will probably soon be illustrated by Mr. Sullivant.

This work lays the foundation for the study of North American Muscology among us. We now only wait for a *Species Muscorum* of the United States, to facilitate the study of the family for students generally, and this we trust Mr. Sullivant will not be long in giving us.

The view of these beautifully prepared specimens as here presented to us, brings back to recollection their appearance as they grew in their fresh native wilds, and vividly recalls the varied incidents of the arduous but delightful journey during which they were principally collected,—the laborious mountain-ascents, the night bivouacs, the healthful woodland life and primitive fare, and the many amusing adventures, of a tour which extended along the principal length of the Alleghany Mountains, through much of their most picturesque scenery, and through regions which abound with the choicest botanical treasures which the country affords. A cursory indication of the particular routes pursued will not be deemed superfluous, since it is recorded by our author only in the general terms of the title page. The expedition, which had for its principal object, on the part of one of its members, the collection of live plants for the Cambridge Botanic Garden, may be said to have commenced, late in August, 1843, in the mountains of Maryland and Pennsylvania, where they are traversed by the Cumberland road. From the Potomac at some distance above Cumberland, the great *Back Bone* of the Alleghanies was crossed in Maryland, where it presents a pretty formidable elevation, and several plants were observed which were thought to be confined to a more southern range, such as *Menziesia globularis* and *Galium latifolium*. The open *glades* on the other side presented many features of Kentucky vegetation. Virginia was entered near Mount Carmel Town, and a rude, wild region was traversed to Tygart's Valley River, in Randolph County. The high Cheat Mountain was then crossed nearly where it merges in the Green Brier range, and *Angelica Curtisii*, BUCKL., as well as *Aconitum reclinatum*, GRAY, were first met with. In the journey through Pocahontas County to Huntersville, fruiting specimens of the little known *Rhamnus parvifolius*, TORR. and GR. Fl., were collected, a species which proves to be a perfectly distinct one, and has also been found by Mr. BUCKLEY in Alabama. In the route eastward across the mountains from Huntersville to the Warm Springs, the rare *Helianthus lævigatus*, TORR. and GR., and *Andromeda floribunda*, PURSH., (which is *A. montana* of BUCKLEY,) were abundantly found. A mountain meadow on Nap's Creek, east of Huntersville, also furnished a stout *Gentian* with crowded ochroleucous flowers, and with much the habit of *G. Andrewsii*. It was naturally enough confounded with *G. ochroleuca*, and specimens have been distributed under this name. It is however quite a different species from the real *G. ochroleuca*, though it may be the plant figured under that name in *Sims. Bot. Mag. t.* 1551, as well as the form mentioned by GRISEBACH (in HOOK. fl. Bor. Am.) as remarkable for its cordate-lanceolate leaves. Our *Gentians* will soon be cleared up, we trust. Meanwhile a temporary diagnostic character is given below.* From the Warm Springs the expedition pursued its course, by way of the Hot Springs and the White Sulphur Springs, along the base of Peter's Mountains to the Kanhawa River, which was crossed at Toney's

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* GENTIANA FLAVIDA, (GRAY :) caule erecto lævi; foliis e basi cordata arcte semiamplexicauli ovato-lanceolatis sensim acuminatis subtrinerviis margine scabriusculis; floribus terminalibus aggregatis sessilibus; calycis lobis ovatis tubo plusquam dimidio corolla multo brevioribus; lobis corollæ apertæ ochroleucæ (intus haud viridi vel purpureo picta) ovatis plicas denticulati-erosas integras subduplo excedentibus; capsula intra corollam persistentem fere inclusa; seminibus latissime alatis.—Stet inter *G. ochroleucam* et *G. Andrewsii*.

Ferry below Parisburg, and thence to Tazewell County. In Giles County, soon after crossing the river, live roots of the very rare and distinct *Heuchera hispida*, PURSH., were obtained, which have been preserved in cultivation. Clinch River was crossed above Saltville, and the North Fork of the Holston at Seven-mile Ford; the Middle Fork was ascended to within a few miles of the place where the writer crossed the Iron Mountains on a previous journey, and this range was ascended by a new road a little farther westward. In consequence of this, the remarkable *Carex Fraseriana* was met with, in immense quantities, through some miles of moist wood-land, within the borders of Virginia, whence an adequate supply has been secured for cultivation. Entering Ashe County, North Carolina, the Negro Mountain was first visited; the Grandfather sedulously re-explored; and then Table Mountain was visited by crossing the Blue Ridge into Burke County. Besides the plants before known at this locality, a single patch of the curious *Schweinitzia* was found. Continuing southward to the Catawba, the Blue Ridge was again traversed by Swananoa Gap into Buncombe County, and the route along the French Broad River explored to the Warm Springs, Paint Rock, and to within the borders of Tennessee; where, among the phanerogamous plants obtained for cultivation, the most interesting is the *Buckleya* of TORREY, a Santalaceous shrub, allied to *Pyrularia*. Here the expedition bifurcated, to use a botanical phrase,—one of its members crossing the Cumberland Mountains into Kentucky; the other, returning to Ashville, visited Hickory Nut Gap, then explored the high mountains in Haywood and Henderson Counties, near the sources of the French Broad and Pigeon Rivers, (the Great Balsam Mountain, the Devil's Court House, &c.;) again crossed the Blue Ridge to Cæsar's Head, in South Carolina, ascended the far-famed Table Rock, which is certainly one of the greatest curiosities in the United States; thence continued his course to Augusta, Georgia, and returned northward by the usually travelled route. We must not prolong this article by farther notices of the interesting plants, which the memory of this botanical journey so vividly recalls to mind.

A. GR.

ART. VII.—*An attempt to refute the Reasoning of* LIEBIG *in favor of the Salt Radical Theory;* by ROBERT HARE, M. D., Prof. of Chem. in Univ. of Pennsylvania. (In a letter to the Editors.)

1. *Gentlemen*—My attention was lately drawn to two lectures delivered about eighteen months ago, by LIEBIG, in support of the salt radical theory. You are well acquainted with the efforts made by me to refute that hypothesis, in an essay published under your auspices.[*] Your opinions, as well as those of several of the more distinguished of our American chemists whom I have consulted, have been emphatically expressed in favor of the validity of my reasoning. Nevertheless from the lectures above mentioned, and from a text book lately published by GREGORY, the successor of HOPE, it appears that, by these eminent professors, innovations are to be supported which have, on this side the water, been deemed indefensible. Under these circumstances, I again raise my voice against this new doctrine, hoping that although an ocean rolls between those who may be led astray and the author of this communication, his warning may be neither unheard nor unheeded.

2. Pursuant to the new doctrine, every oxacid is to be considered as a hydruret of a compound radical, as those heretofore called hydracids are hydrurets of simple radicals, so that both of these classes are to bear the name of hydracids.

3. Agreeably to the nomenclature proposed by DANIELL, the hydrated sulphuric, nitric and phosphoric acids consist of hydrogen in union severally with oxysulphion, oxynitrion and oxyphosphion, their formulæ being respectively SO^4H, NO^6H, PO^6H.

4. According to a definition given by LIEBIG, at the close of his second lecture, "*acids are compounds of hydrogen with simple or compound radicals, in which the hydrogen may be replaced by its equivalent amount of metal.*"

5. Inferring that in those oxacids which unite with water as a base, the oxygen of the water goes to form a compound radical, the constitution of these acids is considered as quite analogous to that of the compounds formed with hydrogen by halogen bodies,[†]

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[*] See this Journal, for Jan. 1843.

[†] Chlorine, bromine, iodine, fluorine and cyanogen, are by BERZELIUS distinguished by the generic name halogen, from Greek words which convey the idea

whether simple, like chlorine, bromine, iodine and fluorine, or compound, like cyanogen. Hence the term hydracid, heretofore confined to the haloid compounds of hydrogen, and those formed by this element with sulphur and selenium, is to be extended to all the hydrated oxacids. Moreover respecting oxacids which are incapable of uniting with water as a base, the distinguished lecturer holds the following language. "*I maintain that they are not acids. Do you find any of the characteristic properties of the hydrogen acids, in chromic acid, boracic acid, silicic acid, titanic acid, antimonic acid, or in their combinations with metallic oxides?*"

6. The lecturer also uses the following language. "*The compound which we denominate hydrated sulphuric acid, possesses properties analogous to hydrochloric acid.*" And again: "*There is no proof that our common sulphuric acid contains water; but we can prove that its chemical character, analogous to that of hydrochloric acid, depends, as in that acid, on the presence of hydrogen. We can prove that this hydrogen can be replaced by its equivalent of metal.*"

7. This celebrated author has, in a preceding paragraph, urged "*that the so called anhydrous sulphuric acid, and phosphoric acid, do not possess any of the characteristic properties of acids; these they obtain only by their combination with water.*"

8. As the characteristic properties of "the hydrogen acids" are not only in the instances here cited, but in others, repeatedly insisted on by LIEBIG as a corner stone of the new system, it is unfortunate that they are no where described. It is to be regretted that LIEBIG does not specify any properties characteristic of acidity, which belong both to the hydrated oxacids and the gaseous "*hydracids*" (so called) formed by the union of hydrogen with the halogen bodies of BERZELIUS. Neither the latter nor the former, while undiluted, are endowed with sourness, nor with the

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of salt and to produce. Common salt, from which the notion of salt first originated, being a binary compound of chlorine and sodium, all other binary compounds of chlorine, or of any of its congeners which belong to his halogen class, are called salts, and the compounds of these double salts, although there are no bodies in nature more dissimilar in their properties than some of those thus constituted; as for instance the gaseous compounds formed with hydrogen, the volatile liquid and fuming chlorides of tin and arsenic, the butyraceous chlorides of zinc, bismuth and antimony, and such inert chlorides or fluorides as horn silver, horn lead, and fluor spar.

ability to redden litmus; and were they thus endowed, it could not be of any importance to the argument, since according to LIEBIG, "*We have long since abandoned the position, that mere reaction with test paper should decide whether or not a body should be called an acid or not.*" But if reaction with test paper be thus set aside, the inferior test of sourness cannot but share the same fate.

9. It seems to me that there has been a lamentable deficiency of precision in LIEBIG's expressions respecting the resemblance between the hydrated oxacids and the haloid* hydracids. I call upon him, or any of the advocates of the salt radical theory, to point out any peculiar attributes of acidity belonging to them in common. The whole source of this idea would seem to be a vague conception, that the vulgar attributes of acidity belonging in common to diluted sulphuric and diluted muriatic acid, are attributable to the hydrogen of the basic water in one case, and that of the hydrogen of the gaseous chloride in the other. But to lay any stress on this resemblance, is irreconcilable with the above quoted allegation of the celebrated author, that the effect upn test paper is no longer to be considered as an evidence of acidity. Yet besides this attribute and that of sourness, what other common properties, distinctive of these diluted acids, can be imagined? The evolution of hydrogen by reaction with metals, cannot avail unless water, equally capable of that reaction, be made an hydracid, and oxygen consequently transferred to the halogen class. But if this transfer be made, the salts heretofore considered as simple amphide salts, become as well entitled to be deemed double haloid salts, as any of the double chlorides.

10. Is it not evident that the whole of this salt radical doctrine, as presented by LIEBIG, is founded on an unnatural and arbitrary peculiarity attached to oxygen on one side, and to hydrogen on the other, by which each of these elements is treated as a body *sui generis?* Upon what rational ground is oxygen separated from the other electro-negative elements forming the amphigen and halogen bodies of BERZELIUS?

11. If chlorine be a simple radical, wherefore is not oxygen a simple radical? But if oxygen be a simple radical, agreeably to LIEBIG's definition above quoted, (3,) water, the oxide of hydro-

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* A haloid compound is one which contains a halogen body as an ingredient.

gen, is as much entitled to be considered as an hydracid, as muriatic acid, (the chloride of hydrogen.) The oxide, no less than the chloride, consists of a "*radical in combination with hydrogen in which the hydrogen may be replaced by a metal.*" Hence, as no rational line of demarcation can be drawn about oxygen, so as to separate it from its congener chlorine, it follows either that all the compounds consisting of two chlorides, and hitherto called double chloro-salts by BERZELIUS, are consistently simple chlorosalts; *or*, that all compounds consisting of two oxides and called simple, should be considered as double oxysalts.

12. The supposed hydracids, consisting of oxacids containing only basic water, being liquid, while the hydracids proper, when equally devoid of water, are aëriform; had the comparison been made between them, neither being associated with water as a solvent, the idea of any similitude could hardly have arisen. Besides unless so associated, they are generally insusceptible of change by reaction with metals without heat, and when subjected to decomposition, there is no analogy in the result. In the case of hydracids proper, the halogen body uniting with any metal presented to it, hydrogen is evolved; but in that of the hydrated oxacids, the alleged compound radical is decomposed with an evolution of some combination of the non-metallic ingredient with oxygen. Thus instead of hydrogen, sulphuric acid yields sulphurous acid, nitric acid yields nitric oxide. It follows that the presence of basic water alone, does not fulfill the conditions of LIEBIG's definition, since *per se* the hydrogen entering into combination with the alleged compound radical, cannot be replaced by a metal.

13. It may be expedient here to advert to the fact that in the case of magnesium and aluminium, oxygen plays the same part in taking place of chlorine and causing the *chloride* of hydrogen to be evolved, that chlorine performs in the cases of various oxides in which oxygen is replaced by chlorine and the *oxide* of hydrogen is evolved. Again, the reaction of muriatic acid with any bromide or iodide of which the metallic ingredient prefers chlorine to bromine or iodine, is analogous to the reaction of the same hydracid with certain oxides which prefer chlorine to oxygen.

14. It is therefore clear that in the reaction of haloid compounds with each other and with oxides, there is a perfect analogy, and that the erection of a special genus for oxygen is unjustifiable.

This conclusion is fortified when oxygen is considered in relation to sulphur or selenium, with which it is classified by **Berzelius**. There is, as I think, also a perfect analogy between the reaction of water with certain metallic sulphides, and of muriatic acid with certain oxides; and I presume that the same may be said of the reaction between water and some selenides.

15. As respects the propriety of holding up hydrogen as an element *sui generis*, the advocates of the salt radical doctrine do not agree with each other; since according to **Kane**, and **Graham** also if I remember right, hydrogen is an aëriform metal, an opinion which I embraced independently more than twenty years since. But I trust that in my essay above alluded to, **Liebig**'s reasoning in reference to this question is shown to be founded upon this palpable inversion of the truth, that the capacity of acidifiable radicals for metals is assumed to be dependent on the quantity of hydrogen with which they are capable of combining; instead of the quantity of hydrogen which can unite with them, being directly as their capacity for it or any other body in the table of equivalents.*

In a communication which I intend to send you for the next number of your Journal, I hope to proceed with the refutation of **Liebig**'s reasoning.

Art. VIII.—*Account of observations on Shooting Stars at the meteoric periods of August* 10 *and November* 13, *in the year* 1845; communicated by E. C. **Herrick**.

Arrangements were made here for meteoric observations during the nights of the 8th, 9th, 10th and 11th of August, 1845. Casually, on some of the earlier evenings of this month, meteors seemed by brief observation, to be more numerous than usual, but as there was no systematic watch, nothing definite can be stated concerning their numbers.

The evening of the 8th was almost wholly overcast, and the sky continued cloudy during the night.

On the evening of the 9th, Messrs. **Geo. C. Murray**, and **Wm. Manl. Smith** with myself, commenced observations in the open air, at 10^h. We saw some meteors previous to this time, but have not included them in our enumeration. Between 10^h and 11^h, we observed *sixty four* different meteors as follows, viz. in

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* See paragraphs ninety one, &c. in my Essay in this Journal, for Jan. 1843.

N. N. E. 22. S. E. 20. S. W. 22.

During this hour the sky was not entirely clear, and our view was somewhat obstructed by trees. These obstacles may have occasioned a loss of about one tenth. Of the shooting stars observed many were conspicuous, and left brilliant trains. The apparent paths of the majority of them, if traced back, would meet near the sword-handle of *Perseus;* as has been observed on many former occasions, at this period. Soon after 11^h the sky became much clouded, (but not until we had seen seventeen meteors more) and as late as 1 A. M. (10th) offered no chance for observation. At this hour we left the field, and have reason to suppose that the sky continued cloudy until daylight.

The night of the 10th was overcast and rainy. The night of the 11th was similar; and on neither was any observation practicable.

On referring to our observations at the August period in former years, it appears reasonable to conclude, even from the limited observations which the weather permitted us, that the expected display did not fail this year; and that had our sky been clear on the nights of the 9th and 10th, we might have seen (if four had been observing) shooting stars between midnight and dawn at a rate not less than 150 an hour.

By a notice in *L'Institut*, No. 606, Paris, 13 Août, 1845, it appears that in France, (at Paris?) M. Coulvier-Gravier, aided by two companions, observed and registered shooting stars, on the night of Aug. 9th, 1845, as follows:

from 9 to 10 P. M.	60	from 12 to 1 A. M. (10th)	77
" 10 " 11 "	63	" 1 " 2 " "	117
" 11 " 12 "	64	" 2 " 3 " "	136

As to direction it is merely remarked that the majority came from the northeast.

Observations at the November Meteoric period.

Since the year 1838, no decided return of the meteoric display of November has been announced; nor indeed does the theory proposed by Prof. Olmsted, require the annual occurrence of this phenomenon. It is nevertheless quite important that observations should be maintained, in order, either to determine the negative, or else to secure the first symptoms of a return of the grand meteoric shower, which sooner or later may be expected at this period.

November 11, 1845. Being called out by an alarm of fire, I watched for five minutes, about 2 A. M., and saw no meteors. The sky was very clear and the moon shone bright.

Nov. 12. On looking from an open window at 5^h 15^m A. M., I found about one third of the sky almost clear. The constellation *Leo* was wholly unobscured and also a large space around, quite enough for one observer. In a few minutes I was at my station in the open air and began the watch. The clear space gradually contracted, and within fifteen minutes the sky became wholly overcast. During this brief period, I did not certainly observe even *one* meteor, although I suspected that I caught glimpses of two.

Nov. 13. Mr. J. H. LANE and myself began the watch at 4^h 10^m A. M. The sky was clear, except there was a bank of clouds low in the northwestern horizon, not however interfering with observation. During the hour ending 5^h 10^m our region (from N. by way of E. to S. 10° W.) remained clear, and we observed *six* different meteors. One of the six was seen by both, but was only once counted. Of these six, five were conformable to the radiant in *Leo*, and four left luminous trains. Mr. FR. BRADLEY, watching at a separate station, from 3^h 45^m to 5^h A. M., looking easterly, observed nine shooting stars, eight of which were conformable.

Nov. 14. At 3 A. M. I looked from an open window and found the sky so hazy that stars below the second magnitude were not visible. During a short period of observation, not exceeding five minutes, I saw not even a single meteor.

It should be remembered, that during this period, the moon, nearly full, was above the horizon, concealing about three fourths of the meteors that might have been seen in her absence. But even with this allowance, it must be admitted that the results above recorded indicate no recurrence of the meteoric shower of November.

New Haven, Conn., Nov. 1845.

Art. IX.—*Attempt to Demonstrate the Assumed Point in the Doctrine of Parallels;* by A. C. Twining, Prof. of Math., Nat. Philos. and Civil Engineering, in Middlebury College.

A concise and rigorous demonstration of what is called the *postulatum* of Euclid,—that is to say, that *two straight lines which make, with a third line, interior angles together less than two right angles, will meet if indefinitely produced,*—is still accounted among geometrical writers a desideratum. The author of the able Treatise on Geometry put forth in England by the "Society for the Diffusion of Useful Knowledge," not only announces the difficulty in the text itself, but declares, in a scholium, that it is agreed by geometers that some assumption is indispensable. The numerous although abortive attempts, however, to resolve the difficulty, extending from the earliest periods of the science quite down to our own times, and still in process of continuance, evince that a hope at least is still entertained by the lovers of exact reasoning of wiping away the reproach, as they esteem it, of their favorite branch of knowledge.

It is here worth an inquiry why the one difficulty in the doctrine of parallels has monopolized attention and anxiety to the exclusion (to say nothing of a plain assumption in the 21st of the first book of Euclid, and the same in the corresponding 9th of the first book of Legendre, which however I expect at some subsequent opportunity to exhibit, as reducible to demonstration in a distinct proposition) of two equally palpable infirmities that subsist in the definitions themselves; one in the ordinary definitions of the straight line, and the other in the definition of a plane surface. Proof, as it would seem, may justly be demanded that there can be lines of such a property that two cannot coincide in two points without coinciding throughout—or, as the axiom shapes it, cannot "enclose a space." Neither can the adopted "shortest distance between two points" relieve Legendre's system; for, although most evidently there is a "shortest distance" in *amount*, yet what geometer, unless a very late one, has shown that there is but *one specific path* in space to which that least amount can be attributed. Again, in what estimation shall the exact reasoner hold the ordinary definition of a plane? It would indeed be admissible, supposing a straight line properly defined, to describe that species of surface to be one which can contain all lines that can pass through a given point to cut a given straight line indefinitely produced; but how is it to be ascertained, that any two points not in that given line being taken in that surface, the line joining them shall cut the lines between, that lie in and define the surface?

The undeniable existence of these defects, in addition to the vexed one of parallels, gives dignity and value to an attempt of Mr. T. PERRONET THOMPSON, of Cambridge University, in England, in his "Geometry without axioms," to deduce the elementary properties of the straight line and plane from the sphere alone. The same author has discussed with much sagacity, in his appendix, the methods and devices,—about thirty in all,—which, during the historical period of the science, have been proposed to obviate or evade the difficulty relating to parallelism; and he has exposed, with a clearness seemingly incontestible, fallacies in each. Mr. THOMPSON has also propounded, in his text, a series of propositions which purport to compose a rigorous proof of the entire doctrine; and this, not improbably, with justice; but the prolixity of the process is sufficient, in some instances, to deter one, for the moment, from pursuing it through the somewhat intricate figures.

The author who has made the most persevering and repeated endeavors to complete the doctrine of parallels—supplanting certain of his earlier methods by new ones, and pertinaciously maintaining to the last the rigorous character of others—is the celebrated LEGENDRE. The *conception* of the method first given in the twelfth edition of his Geometry is very elegant; as also its execution in all those steps which are rigorous, and by which it is in fact demonstrated, that if a triangle be given, there may be constructed another triangle having its three angles equal, in their sum, to the sum of the three of the original triangle, and two of its angles less than any assigned angle. Hence it was inferred that by the repeated bisection of one of the angles at the base, the whole triangle may be considered as coinciding with its base, and the exterior angle as less than any angle assigned. The weakness of the conclusion is found in this,—that, since the sides containing the continually bisected angle increase *pari passu* with the diminution of the angle, the apex of the triangle may, for aught that appears, be of any assignable length, and *may* be competent, therefore, to subtend an assignable angle.

With respect to the *analytical* proof proposed by the same author, based upon the theory of functions and the principle of homogeneity, I should have called it hardihood to defend its conclusiveness against the undeniable objection of Prof. LESLIE, that the identical argument by which LEGENDRE attempts to show that the third angle of a triangle is determined by the other two, would show that the third side is also determined alone by the other two, had not the attempt to defend its conclusiveness been made both by its author and by men in the same rank of talent. To what has been written on that subject, I may be permitted, perhaps, to add one or two brief inquiries, as follows: First, how conclusive so ever the proof in question may appear to analysts of a certain practiced and subtle penetration, yet, inasmuch as the purpose of a *demonstration* is to manifest truth to those who are in the capacity of being taught, can it be demanded of *ordinary reasoners* to conclude that, because two triangles having two equal angles adjacent to one equal side would coincide, and have their third angles equal, that, therefore, if the side were varied, *the other two sides would meet as before;* and, moreover, that the third angle in this and the former triangles would be *one and the same function* of the side and the angles adjacent to it,—that is to say, that there is *some specific arithmetical process* by which the third angle may be deduced from the three quantities or elements named? All this, however, is demanded in the outset of the proof under consideration. Again: it will be conceded, I presume, that no property *peculiar to straight lines* can be demonstrated without the introduction *somewhere* in the proof, either explicitly or implicitly, of at least one step dependent on some property known, either by definition or by antecedent evidence, to pertain exclusively to such lines. My second question, therefore, would be, what one step of the so called analytical argument embodies any such peculiar property?

Among LEGENDRE's methods of proof, there is one proposed in a note to Prop. XIX, of the 12th edition of his Geometry, which depends upon the equal division of an infinite plane by an infinite straight line, and the consequent necessity inferred in the argument, that a straight line contained in an angle must, if produced, eventually meet the containing sides (one side it should be) of the angle. But the argument, as Mr. T. P. THOMPSON in his examination has pointed out, equally proves that two parallels can not exist,—and for this reason, probably, it may be that LEGENDRE himself, in his ultimate and general memoir on the subject of parallels contained in Vol. XII, of the "Mémoires de L'Académie Royale," has made no account of that method. Had the argument, however, turned upon the comparison of the contained angular space with the exterior space in the way of *ratio*, instead of *absolute excess or defect*, (as it will be obvious to all familiar with that argument that it might have been made to do by continually bisecting the interior angle until a part should be found less than the excess of the whole exterior over the interior,) the proof would have rested unapproachable by the objection named. The only possible doubt would then have been whether the space on the side of the contained line opposite to the angular point is certainly a part of the interior angular space alone; yet that it must be such is, if not perfectly axiomatic, at least so nearly axiomatic as to give to this simple method, so modified, in my own apprehension, at least, a superiority over all others, including those of LEGENDRE himself and the *suspicious* although certainly simple and specious method of BERTRAND.

But, not to prolong discussions and comparisons beyond the demands of my immediate object, I pass to the development of an attempt of my own by which I propose to complete the doctrine of parallels and to make the *postulatum* of EUCLID independent, in fact, (in the simple case in which one of the interior angles made with the third or cutting line is a right angle) of any antecedent proposition.

To this end I employ a particular relation—whether positively or negatively assumed in hypothesis—of lines containing an angle to the angular space; which relation, or *possible* relation, if that qualification should be insisted on, appears not to have been heretofore reflected upon, or even noticed for any purpose of demonstration or investigation,—and which constitutes, therefore, if I err not in my application of it, a novel element of geometrical reasoning; notwithstanding that I am not able to determine what other than the special applications I shall make, it may be expected to be susceptible of. The element or relation referred to is nothing more than the truism that, if two straight lines meet, either of them *belongs* or does *not belong* to—or (if that phraseology be preferable) *is* contained or is *not* contained by—the angular space bounded by the lines, and consequently, would be contained either by *both* or by *neither* of two such precisely similar spaces on opposite sides of the line. This is an assertion intelligibly true, without the requirement of any subtleties or even any conjectures as to the proper choice of sides in the alternative; but our argument, as will presently be seen, allows the objector to be dogmatical as to the one side or the other, or to stand in hesitancy between the two. But, if any one should deem it an additional satisfaction to conceive, with the utmost precision, what is intended by the expression "a line belonging to or contained by an angular space," I may, without involving the merits of the argument in any specific definition of which it and its fundamental principle are independent, explain my individual conception of the interpretation, which, moreover, I suppose to coincide with that interpretation and idea that would spontaneously suggest itself to a mind imbued with even no more than the most elementary geometrical conceptions. Every geometrical magnitude is a definite extension. A sphere, for example, which is given in dimensions and fixed in position, occupies, throughout its entire extension, *place* or *position*,—that is to say, throughout the whole, *points* may be taken,—and those *belong to* or *are contained by* the sphere. The same is true of points of an angular space, and, by consequence, of a line of the same. The idea, like the idea of *distance*, is simple and plain, and, like that, capable of being *referred to* and *recognized* but scarcely of being made plainer by definition.

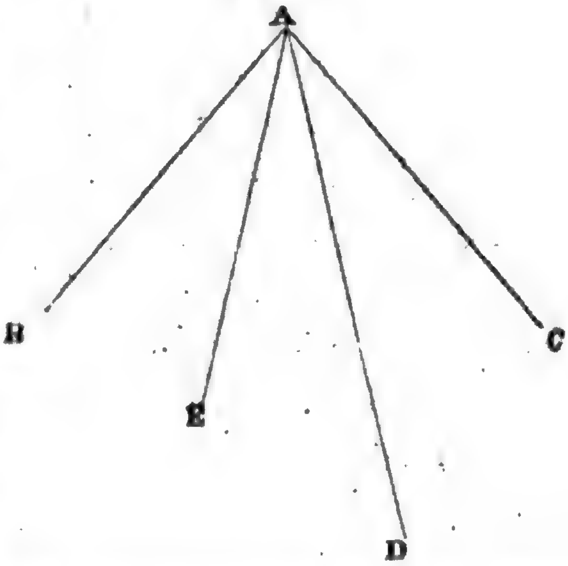
If, however, any one should suppose, that a line which belongs to or is contained by an angular space must have a portion of that space on both sides of it, the reader can judge, after becoming possessed of the argument, whether, even in the sense of such a definition, he can deny my principle, as above stated, or subvert its conclusive application. Yet such a definition does, in effect, deny that a magnitude occupies *place* up to its extreme boundaries. A better definition would be, that the contained line must be *between* the bounding lines of the angular space; but this would compel the definer to adopt the *negation* of our alternative,—so as to begin, not like our argument, "the line *does* or does *not* belong," &c., but, "the line *does not* belong," &c.

One caution only is requisite to bespeak a due appreciation of the chain of proof I am about to offer. Lest the reader might, in the outset, enter upon it with a presumption that from such a truism as that above stated, no conclusion, and none, especially, which has baffled the skill applied to it in so many forms, can legitimately spring, I would propose the inquiry whether, in case some one of the more recondite truths of geometry—as, for example, the ratio of a sphere to its circumscribing cylinder—should, by a flash of reasoning and through a brief step or two, be connected with the ordinary and unexceptionable definitions, the latter might not, just as unavoidably, seem inadequate to contain or give origin to such a conclusion as the former?

PROPOSITION.

Two straight lines which make, with a third line that cuts them, the two interior angles together less than two right angles will meet, if indefinitely produced.

Fig. 1.

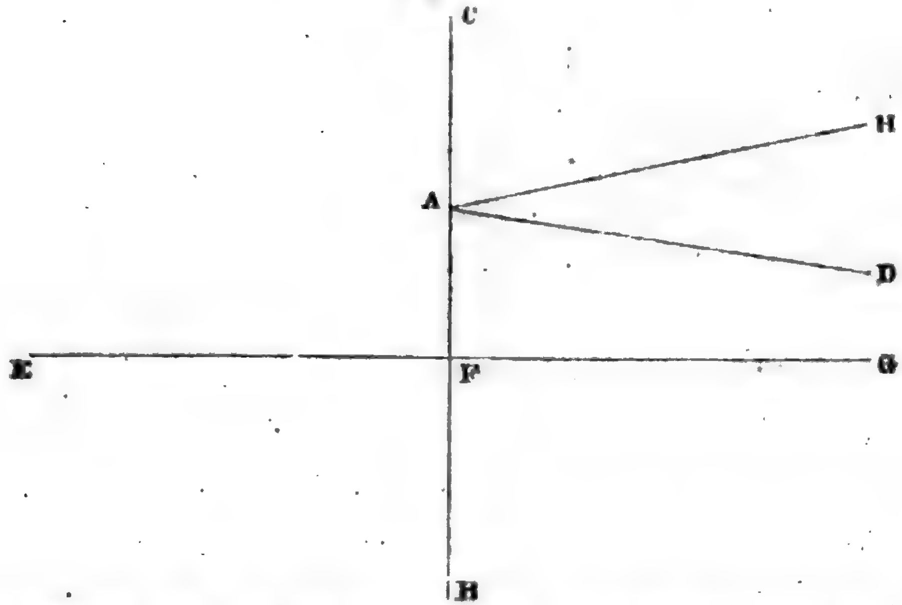


Demonstration.–Let the straight line AD (fig. 1) divide the angle BAC; and, if it divides it unequally, cut off from the greater part, as DAB, an equal, DAE, to DAC the less.

The straight line AD either belongs to, or, in other words, is contained by the angular space DAC or it is *not* contained by it. And if, by the nature of an angular space, it *is* contained by DAC it must evidently be, in like manner, contained by DAE; and if *not* contained by DAC it is not contained by DAE; but, if contained by DAE, the construction of an adjoining angle EAB cannot affect that fact nor, *mutatis mutandis*, the contrary. We therefore see that, if a line divides an angle, it must be contained by both parts or by neither,—so that either the two coincide in that line or are separated by it. On whatever condition, therefore, an angle, as DAC, shall have been constituted, (as, for example, by drawing AD and AC through fixed points,) it is not allowable to constitute an adjoining angle DAB on such a condition as shall exclude AD from either being contained by both angular spaces or else, by neither.

Let then EG (fig. 2) be an indefinite straight line, and A a point without it. Let AB be a line cutting EG at right angles in F, and produce BA to C.

Fig. 2.



Let the angle BAD be constituted by the condition that it can contain all the lines drawn through A that can meet FG infinitely produced on the one side of CB towards G. Then I say that the angle DAC cannot be constituted simply on the condition that it can contain all the lines that will *not* meet FG produced as before; for, then, whether AD be contained by *both* BAD and DAC, or by *neither*, it must meet and not meet FG at the same time; which is absurd. In searching, therefore, for the proper constitution of the angle DAC, we observe that, if some point, as E, on the other side of BC from G be united with A, and the line be produced, that line will lie in the angular space DAC; also, if a line be drawn at right angles to CB through A, it will not meet on either side; for if it be supposed to meet on one side, then, for the same reason, it must meet on the other; which is impossible.

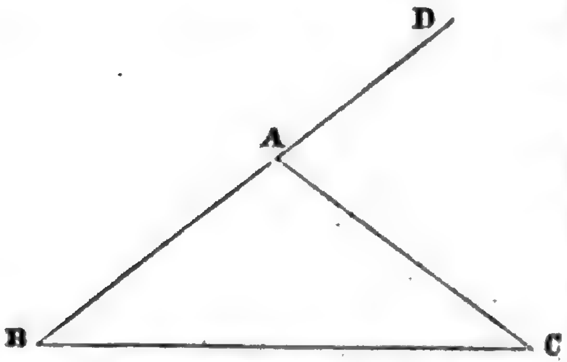
There subsists, therefore, a threefold distinction in the lines that can be drawn in the entire angular space on the one side of BC towards G; first, lines that can meet the line EG on *that one side*; second, lines that can meet the same on *the other side;* and third, a line or lines that can meet on *neither side;* also, it is evident, that in relation to meeting EG, these *are all the distinctions that can subsist.*

If, now, there can subsist more lines than one through A that meet on neither side, let the angle CAH be constituted so as to contain all that can meet on the other side from G, and of course, HAD must contain all that can meet on neither side. Now if AD *is* contained by BAD, it is also contained by DAH,—that is, it meets on the one side, towards G, and on neither side at the same time; which is absurd. But if AD is *not* contained by BAD it does not meet on the one side towards G,—yet it cannot (by what was proved at the first) be contained by DAH, and therefore *must* meet on the one side or the other, and therefore, since that is not on the one side towards G, it must be on the other towards E: therefore, AD is contained by the angular space HAC, from which it is separated by the angular space HAD; which is impossible. Therefore there cannot be any such angular space HAD; but AH and AD must coincide, and there can be but one line through A, that does not meet EG on either side, and that, as has been shown, is the line at right angles to CB.

Now it is well known that if a line cut two others so as to make the two interior angles together equal to two right angles, and if the cutting line be bisected, and from the bisecting point a perpendicular to one of the two lines be drawn, it may be and is proved perpendicular to the other. But it cannot be perpendicular to any other line through either extremity of the cutting line—else one and the same triangle might have two angles both right angles, which is impossible. Therefore, *any other lines than those which make, with a third, the two interior angles together equal to two right angles will meet, if indefinitely produced.*

Corollary.—*The sides of triangles are not contained by the triangular spaces, but are mere dividing lines between the space within and the space without. Also the same is true of all superficial figures. Also the surfaces of solids are not contained by the solids, but are dividing surfaces between the space within and the space without.*

Fig. 3.



For let ABC (fig. 3) be a triangle. Produce BA to D. Now if the only *actual* distinction that subsists among all the lines passing through A, with reference to the limited line BC, is that lines of one class *meet* or *intersect* it and those of another do *not*, we have, on the one side of BD towards C, the angle BAC constituted or defined as that which can contain the *first* only, and the angle CAD as that which can contain the *second* only. Whether, therefore, the line AC is contained in both angular spaces or contained in neither, the absurdity arises that it must intersect and not intersect at the same time. A threefold distinction must, therefore, actually subsist, namely, lines that intersect BC, lines that do not intersect it, and a peculiar line limiting the two, or dividing between the spaces that can contain them; and which, with reference to the line BC, may not improperly be said to *touch* it in C.

The same may, in like manner, be proved respecting any rectilinear figures whatever. But if a figure be curvilinear, it may be circumscribed by a rectilinear figure whose boundary shall touch the curvilinear at any given point; or in other words, may coincide with the curve at that point. Then the curvilinear figure *at the point of coincidence*, is separated, equally with the rectilinear, from the spaces without, by the right line which contains the one given point, which point, therefore, belongs to neither the space within nor the space without, but to the boundary. Therefore any point whatever of the curve does not belong to the curvilinear space; which consequently is, as in the former case, a dividing line.

Lastly, if a solid be cut by a plane, there is a sectional figure which is constituted by all that is common to the plane and the solid, and no more. But the boundary of the section has been proved not to belong to its superficial extension and therefore does not belong to the solid. But it is the section of the solid's boundary by the plane which constitutes the boundary of the figure, and therefore the boundary of the solid does not, *at this line*, belong to the solid; and the same may be proved at any point whatever in the surface of the solid.

Scholium.—Besides the evidence which the principle and manner of reasoning employed above carry in themselves, there are two incidental *symptoms* or *indexes* of genuineness. One is that the resulting truth in relation to a parallel, is made to depend, *as it ought to depend*, upon a property of the infinite straight line in distinction from the finite. Thus, in comparing the proposition and the corollary, we find that the line AC in the latter cannot exist under the conditions of the former, because beyond every such line others may be drawn intersecting the indefinitely produced line. The other is that the truth of the corollary is deducible, at least in a partial case, by a method quite independent of its own argument. For if, in fig. 1 of the proposition, the angular space DAC, instead of being defined as that which *can con-*

tain certain lines, be defined as that which shall contain or be *full of* some physical substance, gold for example, while the adjoining angular space DAB, be defined to be full of some other, as silver, it is plain at once that the line AD is simply a dividing line between the gold and the silver. And—demonstration aside—reflection will perhaps make it apparent that an abrupt transition from that which can contain the lines of one specific property to that which can contain the lines of an opposite or distinct property, can no more take place, except through a *peculiar or dividing line*, than from that which is full of gold to that which is full of silver.

It is essential to observe farther, a twofold, but obvious requisite as to the distinctions that can be employed. First, they must not be *arbitrary*—that is to say, such as either *have no pertinence to the point at issue*, or *do not define the spaces:* Second, a specific distinction being once established as a basis of the argument, *no correlative or homogeneous distinction that can subsist must be overlooked.* Thus, in the corollary, if BC be produced and an angle adjoining BAC be constituted as that which can contain all the lines that will intersect *beyond* C, reason shows two correlatives, neither of which may be neglected, so that the three will stand, *beyond* C, *at* C, *and on this side of* C.

Finally, in the application of our elementary principle or *relation* to analytical geometry, the correlative distinctions of lines in a given case will be perceived to be threefold, manifold or even unlimited, according to the conditions of the application. In the case of lines through a point without a circle they would be threefold—lines that cut the circumference, lines that touch and lines that are capable of neither—or, otherwise they might be, lines that cut in *two* points, in *one*, and in *no* point. In the case of curves with different branches they might be manifold, and in that of a spiral cut by an unlimited straight line they must of necessity be unlimited. Whether, in any of the possible applications, valuable truths, other than the two I have developed, would be the result, there has not yet been opportunity sufficiently to consider.

Middlebury, June, 1845.

[For an editorial note to Prof. Twining's article, see p. 147 of this No.]

SCIENTIFIC INTELLIGENCE.

I. CHEMISTRY.*

1. *Researches upon the Phenomena that attend the Projection of Bodies upon Hot Surfaces;* by M. BOUTIGNY, (Ann. de Chim. et de Phys., Vol. ix, p. 350, and Vol. xi, p. 16.)—Notice would have been taken of these researches before, had it not been from a desire to present a review of all of his memoirs at one and the same time; the third has not yet appeared, but the results already obtained are too interesting to remain longer unnoticed.

The peculiar phenomenon that a drop of water or other liquid presents when thrown upon a red hot surface, that is to say, of assuming a spheroidal form and evaporating but slowly, has been known for a very great length of time, but has never been critically studied. The author has endeavored to determine

1st. The ultimate limit of temperature, at which this phenomenon takes place.

2d. The law of the evaporation of water in its spheroidal condition.

3d. The temperature of the liquids in their spheroidal state, as well as that of their vapors.

4th. If the radiated caloric traverses the spheroids or is reflected.

5th. If all bodies can pass to the spheroidal condition.

6th. If there is contact between bodies in their spheroidal condition and the surfaces upon which they are formed.

7th. If this phenomenon plays any part in the explosions (*fulminantes*) of steam boilers.

The first, concerning the limit of temperature at which the liquids become spheroidal, was determined by the following experiments among others. A drop of water was thrown into a polished silver capsule heated to 392° Fahr., then carefully transferred to an oil bath heated to 302° Fahr., and the water was found to maintain its spheroidal condition until the temperature of the bath descended to 288° Fahr.; then it moistened the surface and evaporated rapidly. This then has been found to be the lowest temperature at which water maintains the spheroidal state. If the quantity of water consisted of several drops, its *sphericity* was lost at 308°. It has been ascertained that the lowest point at which alcohol and ether retain the same form, bears the same proportion to their boiling point, as 308° does to the point of ebullitiou of water,—it being 272° for alcohol, and 142° Fahr. for ether. Anhydrous sulphurous acid does not follow this law, but it is not an easy substance to experiment with; it however assumes and retains the spheroidal condition much below the boiling point of water, which is ascertained by placing a capsule in boiling water and letting the acid fall into it; a large quantity may thus be made to assume the spheroidal shape, but it soon becomes hydrated in absorbing and congealing the watery vapor; thus we have the singular phenomenon of the congelation of the vapor of water in boiling water.

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* Dr. J. LAWRENCE SMITH, of Charleston, (S. C.,) who is already well known to the readers of our first series as an able chemical contributor, has kindly consented to continue his labors under this head in the present. His abstracts will always be followed by his initials, to distinguish them from our own,—as those of Dr. GRAY in botanical science and bibliography, are known by "A. GR." It is our intention to follow closely the progress of the various departments of science at home and abroad, by giving condensed abstracts of all that is most interesting and valuable to American readers, diligently culled from the foreign journals, and presented in a readable form at the earliest possible moment. To effect this, we are in the regular receipt of all the most valuable European journals of all languages, besides having the kind aid of several gentlemen eminent in their several departments.

We shall follow the general order of—I. CHEMISTRY. II. MINERALOGY and GEOLOGY. III. ZOOLOGY. IV. BOTANY. V. GENERAL PHYSICS.—*Eds.*

These facts establish that *the temperature necessary to cause a body to pass to the spherical state, is higher as its boiling point is greater.*

The next series of experiments were to ascertain the law of the evaporation of the water while in its spheroidal condition. At 392° Fahr. a grain and a half of water took 3·30 minutes to evaporate; at 752°, the same quantity of water was evaporated in 1·31 minutes; at a dull red heat, in 1·13 minutes; and at a bright red, in 0·50 minutes,—*the evaporation increasing with the temperature*, which is contrary to the rule laid down by Klaproth on the subject; but the experiments of the latter were made in iron vessels, and the oxidation of the metal interfered with the accuracy of the results. As regards the temperature of the body while in the spheroidal condition, the author has established the following general rule: *bodies in their spherical condition remain constantly at a temperature lower than that of their ebullition, without regard to the temperature of the containing vessel,*—

That of	Water being	206° Fahr.
"	Absolute alcohol, ...	168° "
"	Ether, ...	109° "
"	Chloric ether, ...	51° "
"	Sulphurous acid, ...	13° "

M. Boutigny has been the first to experiment with sulphurous acid thrown on hot surfaces, and his results are exceedingly interesting. Heat to redness a platinum capsule, and pour into it several grammes of anhydrous sulphurous acid. On observing that part of the glass from which the sulphurous acid is let drop, and opposite to the hand, it is seen to boil rapidly, which ebullition ceases instantly as it falls into the red hot capsule, and its evaporation goes on with an incredible slowness and without any signs of ebullition. If the weather be damp, the acid becomes turbid, and finally loses its transparency, then solidifies, and upon examination the solid is found composed almost entirely of water. If the weather be dry, then no residue is left. The singular phenomenon, of boiling sulphurous acid becoming colder when thrown into a red hot capsule, is not peculiar to it, as boiling water will exhibit the same fact, falling from 212° to 206° Fahr.

If we throw distilled water drop by drop into sulphurous acid in the spheroidal condition, it becomes frozen, even if the capsule be *white hot;* or if we plunge for about a half a minute a small glass bulb containing about fifteen grains of water into sulphurous acid in the spheroidal condition,—withdraw it, and break it, and a small lump of ice will be found within. A still more striking way of making the experiment, is to place the capsule containing the sulphurous acid, at the bottom of a muffle in a furnace heated to whiteness, when if the weather be dry, the evaporation goes on slowly without any residue,—if the weather be moist, ice will remain behind. Again, if a brick be placed upon the plate of an air-pump, around it a layer of binoxide of lead to absorb the acid vapor, and upon that a piece of brick heated red hot, having a cavity that contains a small capsule, into which sulphurous acid is poured, and a vacuum be rapidly produced; the sulphurous acid which ought, so to speak, to explode, does not boil, but evaporates slowly, just as in a white hot capsule, or as at the bottom of the muffle of the furnace; and what is still more remarkable is, that on a damp day the little water that the air of the receiver contains, congeals in the spheroidal sulphurous acid: all other liquids behave in the same way in the vacuum.

The vapors arising from the spheroidal liquids, have their temperature much elevated; and where water and an iron vessel is used, it is decomposed, furnishing hydrogen gas.

Does the heat traverse the liquids in their spherical condition without combining, or is it reflected? This is important to determine, for up to the time of M. Boutigny's experiments, it was pretty generally admitted that it did traverse them; but he has proved most clearly that the heat is *reflected* and not transmitted. A platinum capsule was made red hot, and by means of a support, a small glass bulb containing water was placed very near the bottom of the vessel; the radiated heat soon heated the vessel, and made the water boil; it was now withdrawn, and water poured in, when it immediately assumed the spheroidal condition, and into it was plunged the small bulb before alluded to; but no signs of ebullition manifested themselves, showing clearly that no calorific rays penetrated the spheroid of water. Nor is this result at all affected, if small particles of wood, sand or iron be mixed with the water; and the iron, although so much heavier than the water, will not touch the capsule, but remains in the spheroid until its complete evaporation. If lampblack be mixed with the water, and into it the small bulb of water be plunged, no difference is seen from the former case.

Can all bodies pass to this spheroidal condition? From the author's experiments, he concludes that all bodies *can* pass to this state.

The experiment with iodine is brilliant, and can be easily repeated in a lecture room. Throw in about fifteen grains of iodine into a capsule (almost flat) heated to redness, when it at once assumes the spheroidal condition, and is surrounded with rare and transparent vapors of iodine; withdraw the source of heat, and in a moment after the iodine passes to its ordinary liquid state, moistens the capsule, boils with violence, and gives rise to an abundance of most beautiful vapors. This gives a good idea of the difference existing between the evaporation of a body in its spheroidal condition, and the evaporation of the same body by ebullition.

Experiments were made to ascertain whether the heated surface was touched or not. It is discovered that *the surface is not touched by the bodies in the spheroidal condition.* This was proved in various ways; among others, by placing a drop of water upon an almost flat capsule, (heated,) and on looking at a lighted candle placed at one side of the capsule, it can be seen perfectly without interruption between the capsule and spheroid.* J. L. S.

2. *New Chloride and Oxide of Chrome;* by E. Peligot, (Compt. Rend., Sept. 1844.)—Pass a current of chlorine gas over a mixture of oxide of chrome and charcoal heated to redness, and minute white silky crystals appear, composed of 1 equiv. chrome and 1 equiv. chlorine; it is a degree of oxidation of chrome till now unknown, corresponding to CrO. This chloride becomes green upon exposure to the air, absorbing at the same time the moisture; added to water it immediately dissolves, and imparts to it a green color, if the water happens to contain air, and blue, if the influence of oxygen is avoided; potash gives with this solution a brown precipitate, which is the protoxide CrO. Acetate of potash added to the solution, gives rise to a slow deposition of red transparent crystals, the acetate of the protoxide. It is necessary to take every precaution, in order to obtain these substances pure, so powerful is their attraction for oxygen.† J. L. S.

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* The remainder of the notice, already sufficiently extended, will be furnished at another time.

† It will be seen that the process given by M. Peligot is the same which has

3. *Atomic Weight of Iron*, (Journ. für Prakt. Chem., xxxiii, p. 1.)—The atomic weight of this metal has lately been the subject of investigation by SWANBERG, NORLIN, BERZELIUS, ERDMANN and MARCHAND, and all agree by different methods in making it 350, oxygen = 100 or 28, hydrogen = 1. This is nearly 1 greater on the hydrogen scale than that adopted in the recent works on chemistry by KANE, GRAHAM, &c. J. L. S.

4. *New Metals.**—There have been three new metals lately discovered,—*Pelopium*, *Niobium* and *Ruthenium;* the first two were procured from the Bavarian Tantalite by Prof. H. ROSE, and the latter was found associated with the ore of platinum by Prof. CLAUS. Pelopium and Niobium exist in the mineral under the form of Pelopic and Niobic acids. (Comptes Rend., Dec. 1844.) They resemble the tantalic or columbic acid so closely in all their properties, that it becomes difficult to separate them from each other. Prof. ROSE has however obtained the Niobic acid perfectly pure, and the greatest difference between it and columbic acid appears to be, that it forms when heated with charcoal and chlorine, a chloride that is colorless, infusible and very slightly volatile, whereas the tantalic acid affords a chloride yellow, very fusible and volatile.

The Niobium is readily obtained in its metallic state, by submitting the chloride to the action of dry ammonia, and applying heat, when the metal is reduced with the disengagement of the hydrochlorate of ammonia.

The Ruthenium discovered by Prof. CLAUS, (Chem. Gazet., Feb. 1845,) as already stated, is associated with native platinum, and is procured from what is called the platinum residue, (the residue after treating the platinum ore with nitromuriatic acid.) It is first fused with nitre at a red heat for about thirty minutes, and the fused mass treated with water and dilute acids, which extract the osmium and iridium; the solid matter left is now fused with its own weight of nitre, and kept at a white heat for two hours; the mass is taken out, while still red hot, with an iron spatula, and after cooling reduced to a coarse powder, which is extracted with distilled water; so soon as the water becomes clear, it is decanted. It contains rutheniate, chromate and silicate of potash. Nitric acid is added cautiously, until the alkaline reaction has disappeared; by this means, oxide of Ruthenium and potash, and some silicic acid, are precipitated, as a velvet black powder; after

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been heretofore used for the production of sesquichloride of chromium, during which process the compound now first noticed by M. PELIGOT is also formed, and being mixed with the sesquichloride, has given rise to the discordant statements which have been made regarding this substance.—*Eds.*

* See Vol. XLVIII, p. 400, of this Journal, for some previous notice of these metals.

washing this powder, it is dissolved in muriatic acid, evaporated until the silica separates as a gelatinous mass; it is then diluted with water and filtered. It must not be evaporated to dryness for the more complete separation of the silica, because the chloride of Ruthenium is thereby decomposed into an insoluble protochloride. The filtered solution, which is of a beautiful orange yellow color, is evaporated down to a very small volume, and mixed with a concentrated solution of chloride of potassium, when the salt $KCl+RuCl^2$ separates in reddish brown crystals. J. L. S.

5. *New Acid in Human Urine*, (Chem. Gaz., Nov. 1844, p. 479.)—W. Heintz has obtained a minute quantity of a new acid from fresh human urine; it contains nitrogen, and differs from hippuric acid. Its properties have not yet been fully investigated, nor is there any name given to it. J. L. S.

6. *Atomic Weight of Zinc;* by M. A. Erdmann, (Pogg. Ann., lxii, p. 611, and Chem. Gaz., Jan. 1845, p. 14.)—It was determined by ascertaining the amount of oxygen absorbed by a given weight of pure zinc. The number furnished by this method is 406·591, oxygen being 100. This is 3·365 higher than that admitted by Gay Lussac, and 7·409 lower than that announced by Jacquelin. J. L. S.

7. *Researches upon the Metallic Acids;* by M. Fremy, (Ann. de Chim. et de Phys., Nov. and Dec. 1844.)—It would be impossible to give here any thing like a sketch of these elaborate and highly interesting researches; all that can be done is to state the principal facts discovered by the author. The capacity of saturation of aluminic acid was determined by forming a crystallized aluminate of potash, which ought to be considered a neutral salt; an analysis of it, showed that the oxygen of the acid is to the oxygen of the base as 3 to 1. The *ferric acid* was discovered by M. Fremy, (FeO^3), and is prepared by a method already well known to chemists; but the one preferred by M. Fremy, will be mentioned in these abstracts. It was found that chlorine, passed over chromate of potash heated to redness, furnished beautiful crystals of oxide of chrome; it is an easy process. The *protoxide of tin* was obtained under different forms, brown, black and red. Two modifications of stannic acid were discovered, both having the same composition, but requiring different amounts of bases to form neutral salts; the acids are called stannic and metastannic. Bismuth was found to form an acid with oxygen, Bi^2O^4. The peroxide of lead, PbO^2, formerly thought to be indifferent, turns out to be a true metallic acid, combining with the various bases. The plumbate of potash is remarkable for its beautiful crystalline forms. By treating this last salt with a solution of the protoxide of lead in an alkali, hydrated minium is formed by double decomposition. Copper forms with oxygen an acid,

which is very unstable, containing more oxygen than the deutoxide. The author's researches upon osmium and iridium have already been alluded to, as was the new osmious acid, OsO^3. J. L. S.

8. *Potash and Soda;* by M. Bizio, (Chem. Gaz., 1845, p. 46.)—This author recommends a new method of rendering these alkalies caustic. It is to mix one part of the carbonates in solution with one part of freshly prepared dry hydrate of lime, and allowing it to stand in a closed vessel for twenty four hours, at a temperature of 68° to 78° Fahr., frequently shaking it. The potash should be dissolved in 12 to 15, and the soda 7 to 15 parts of water. The carbonate of lime separates in a granular state, and the caustic ley may be decanted; a weaker ley may be obtained from the residue, by fresh treatment with water. J. L. S.

9. *Prussic Acid;* by M. Witting, (Chem. Gaz., Jan. 1845, p. 47.)—It is recommended to mix the matter taken from any one supposed to be poisoned by this acid, with one sixth its weight of alcohol, and distill over one fourth. If prussic acid be present, the distilled product generally evolves the peculiar smell; to the product a little caustic potash is added, and then a mixed acid solution of the protochloride and perchloride of iron, when prussian blue is formed. If the poisoning was effected by any of the cyanides, hydrochloric acid should be added along with the alcohol. J. L. S.

10. *New Test for Bile and Sugar;* by Dr. M. Pettenkoffer, (Ann. der Chem. und Pharm., Oct. 1844.)—This test is based upon the deep violet tint afforded by the addition of sulphuric acid and sugar to the bile, even when perfectly colorless. It is upon the choleic acid, (which forms the essential part of the bile,) that this reaction takes place. A little of the liquid suspected to contain the bile is poured into a test tube, and two thirds of its volume of sulphuric acid added by drops, so as not to allow the temperature of the mixture to exceed 144° Fahr., as a higher temperature would decompose the choleic acid; then add from 2 to 5 drops of a solution of one part of sugar to four fifths of water, and shake the mixture; if bile be present, the violet red color will appear in a shorter or longer space of time, according to the quantity present. The precautions necessary to succeed are, not to allow the temperature to exceed 144° Fahr.; not to add too much sugar; the sulphuric acid must be free from sulphurous acid. If albumen be present in the suspected liquor, it is best to coagulate it previous to testing, with a little alcohol or heat. If the bile be in small quantity, it should be concentrated in a water bath, extracted with alcohol, and this last evaporated to a small bulk, and the test applied to the solution when cold; this is particularly to be attended to, when the urine and other secretions are the subjects of experiment. By means of this test, bile was detected in the urine of a patient suffering under pneumonia. The

fæces of a healthy man when extracted with spirits and tested, did not show any indication of the presence of bile, whereas in adding a little bile previously to the fæces, the test did not fail to indicate it. In all cases of diarrhœa bile is found in the stools,—so after the administration of calomel and other purgatives. This test reversed, may be used for the detection of sugar, that is to say, a mixture of bile and sulphuric acid is first made, and the suspected liquid added; if sugar be present, the violet red color will appear. This is a ready way of testing diabetic urine.

To test the blood for bile, the albumen is first separated by boiling with alcohol, and the concentrated solution tested as already mentioned.

J. L. S.

11. *Ferrate of Potash;* by M. Fremy, (Ann. de Chim. et de Phys., Nov. 1844.)—After numerous experiments upon this salt, the author points out the following methods as the best for obtaining it. Surround a Hessian crucible with burning charcoal, and introduce 80 grains of pure iron filings; as soon as these are red hot, throw upon them 160 grains of pulverized nitre that has been fused; the action is instantaneous and violent. After allowing the crucible to cool, a reddish violet mass remains, containing a large quantity of ferrate of potash, with a little of the peroxide of potassium that becomes decomposed when mixed with water. The iron must not be heated too long before the addition of nitre, as the coat of oxide formed prevents the reaction. Another way proposed, is to pass a current of chlorine gas into a concentrated solution of potash, containing hydrated sesquioxide of iron in suspension; the liquid soon acquires a purplish red color, and the oxide is dissolved. When the potash is in great excess, a blackish powder is precipitated, which is the ferrate of potash, that has mixed with it a considerable quantity of chloride of potassium; to purify it, it is redissolved, and precipitated by a concentrated solution of potash. It must be dried on absorbent pieces of porcelain. The dry salt should be quickly inclosed in tubes hermetically sealed, as the moisture of the atmosphere decomposes it. J. L. S.

12. *Separation of Oxide of Cobalt from the Oxide of Manganese;* by M. Clöz, (Jour. de Pharm., Feb. 1845.)—This is done by treating a neutral solution of the two oxides with an excess of the persulphuret of calcium or potassium, which dissolve the sulphuret of cobalt formed, the sulphuret of manganese remaining undissolved. This method is particularly well adapted to cases where the quantity of the oxide of cobalt present is very small. J. L. S.

13. *Ashes of Human Blood and Saliva,* (Chemist, Feb. 1845, p. 88.)—One hundred parts of the human blood contain—

Tribasic phosphate of soda,	22·100
Chloride of sodium,	54·769
Chloride of potassium,	4·416
Sulphate of soda,	2·461
Phosphate of lime,	3·636
Phosphate of magnesia,	0·769
Oxide of iron with phosphate of iron,	10·770

One hundred parts of the ashes of the saliva contain—

Tribasic phosphate of soda,	28.122
Chlorides of sodium and potassium,	61.930
Sulphate of soda,	2.315
Phosphates of lime, magnesia and iron,	5.509

J. L. S.

14. *Separation of Tin from Antimony;* by A. Levol, (Ann. de Chim. et de Phys. Jan. 1845.)—If these two metals be in the form of an alloy, reduce to a thin plate, and heat with hydrochloric acid; after boiling for a few minutes, add chlorate of potash in small quantities at a time, until all the metal is taken into solution; now precipitate the metals with a bar of pure zinc, which must be withdrawn after this operation is completed; and then add a portion of concentrated hydrochloric acid about equal to the quantity first employed—this is done without removing the chloride of zinc—the whole is now boiled, and the tin is re-dissolved entirely at the expiration of about one hour, the antimony remaining in the form of a fine black powder, which may be collected on a filter and weighed; the tin can now be precipitated by sulphuretted hydrogen. J. L. S.

15. *Formation of Lactic Acid from Cane Sugar;* by Prof. H. Von Blucher, (Chem. Gazet. Ap. 1845, p. 151, and Pogg. Annalen, Vol. lxiii, p. 425.)—It was formed by fermenting a solution of sugar with well washed caseine, and the following is one of the experiments performed—1400 grms. of cane sugar were dissolved in 6000 grms. water, and 400 grms. moist, (containing 94 grms. dry) caseine, and a sufficient quantity of finely pulverized chalk mixed with it, and the whole exposed to a temperature of 77° to 86° Fahr. In the course of four weeks the whole formed a crystalline paste. After one recrystallization, 870 grms. crystallized lactate of lime, were obtained; and the mother-ley somewhat evaporated yielded 162 grms. crystallized mannite. The latter, however, was not perfectly pure, and contained 3·6 per cent. lime, probably in combination with lactic acid. In the liquid separated by filtration from the mannite, there subsided, on evaporation over the water bath, a further quantity of minute

crystals of mannite, which however could not be isolated from the syrupy liquid, and the whole was therefore evaporated in the water bath. The residue obtained in this manner weighed 732 grms. and contained 12¾ per cent. lime; 350 grms. of this dry residue was dissolved in 1200 grms. of water mixed with caseine and pulverized chalk, and placed in a warm chamber; in 7 days it had become converted into a crystalline paste, from which were obtained on re-crystallization 210 grms. lactate of lime. If the product of 210 grms. be extended to the entire residue 732 grms., this would have yielded 439 grms. of the salt, consequently the above 1400 grms. of sugar would have produced 1309 grms. of lactate of lime, exclusive of loss. J. L. S.

16. *Acetate of Iron, remedy for Arsenical preparations;* by M. Duflos, (Ed. Phil. Mag. 1845.)—It appears from experiment that the hydrated peroxide of iron possesses no efficacy as an antidote where arsenite of potash, (Fowler's solution,) or arseniate of potash have been employed; it only acting where the uncombined acids have been used. The author recommends as a substitute in this case, the peracetate of iron, prepared by adding acetic acid of density 1·06 diluted with two or three parts of water, to the hydrated peroxide of iron prepared in the ordinary way, (there should be an excess of peroxide.) This preparation is administered largely, diluted with water, it being thus much more efficacious. J. L. S.

17. *Analysis of the Tungstates;* by M. Marquerite, (Comptes Rendus, Feb. 1845.)—To the salt to be analyzed, is added several times its weight of pure sulphuric acid, (in a platinum cruicible,) which is at first heated gently, and gradually raised to a red heat; the residue which consists of an acid sulphate and free tungstic acid, is thrown upon a filter, and washed with water charged with sal-ammoniac, by this means the tungstic acid is prevented from combining with the water and traversing the filter; after the washing is completed, the filter and its contents are ignited and weighed. J. L. S.

18. *Test for Nitric Acid;* by E. G. Schweitzer, (Proceed. Chem. Soc. Jan. 1845.)—It became necessary in the examination of the Bonnington mineral water, to test for nitric acid where bromine and iodine were present. It is known that if any fluid, containing even a very small quantity of nitric acid, be concentrated, and mixed with a little pure sulphuric acid, that a concentrated solution of the protoxide of iron when added affords a pink color; when the quantity of nitric acid is greater, the color became brown or black. The effect of this test, (sulphuric acid and protosulphate of iron,) upon salts of iodine and bromine, is to tinge the liquid with the peculiar color of these two substances, but an excess of the protosulphate destroys the colors, which is not the case with nitric acid. The author states that where the

quantity of nitric acid is very small, and that of the iodine predominates, it is necessary to make a comparison within a standard liquid; for this purpose 50 grains of distilled water containing half a grain of iodide of potassium, to which 50 grains of sulphuric has been added gradually, and afterwards 50 grains of a concentrated solution of protosulphate of iron is used; this fluid is of a yellowish tinge. If nitric acid be present, even to the amount of $\frac{1}{3000}$ part, it is made evident by the above test, a brownish color appearing, which becomes more evident to the eye by comparison with the standard liquid just described; when the quantity of nitric acid increases, the color becomes darker. If a bromide be present, instead of an iodide, the nitric acid is ascertained with the same facility, by its imparting a greenish hue to the liquid; 50 grains of pure water, containing half a grain bromide of potassium, to which 50 grains sulphuric acid are added, will indicate $\frac{1}{2000}$ part of nitric acid by the development of a brownish tinge; this being brought about first by the liberation of hydrobromic acid by the sulphuric acid, and the subsequent decomposition of it by the presence of free nitric acid. The presence of organic matter affects the delicacy of this test. J. L. S.

19. *Preparation of pure Phosphoric Acid;* by Dr. Gregory, (Med. Gazet. 1845, and Chem. Gazet. May, 1845, p. 216.)—This author has recommended in his recent work on chemistry, the preparation of phosphoric acid directly from burnt bones; the only difficulty attendant upon it, being the separation of the phosphate of magnesia, which he has advised to do by means of alcohol. This method, however, upon more recent experiments, has proved not to answer, and Dr. G. therefore recommends the following:—Having removed the lime by means of sulphuric acid, and evaporated the filtered liquid, (filtering again if any sulphate of lime separates during the evaporation,) to the consistency of syrup, a few drops of sulphuric acid are added to make sure that no lime remains. Of course if turbidness ensues, the lime has not been completely separated before, and the addition of sulphuric acid, filtration after adding some water, and evaporation must be repeated till the syrupy liquid continues quite clear, when sulphuric acid is added. This liquid now contains only the phosphoric acid, the magnesia, and the excess of sulphuric acid. It is concentrated, heated in a covered platinum crucible until the whole of the sulphuric acid has been expelled, and the residue has acquired a low red heat. On cooling it forms a glass perfectly colorless and transparent, which contains only phosphoric acid and the magnesia of the bones. This glass when boiled with water dissolves rather slowly but completely. When the solution is again concentrated in a capsule of platinum until most of the water is expelled, and the temperature rises to between 595° and 600° Fahr.,

it suddenly while hot, becomes turbid from the separation of a peculiar phosphate of magnesia; at the same moment the phosphoric acid begins to crystallize like granular sugar deposited in honey, a form ascribed by PELIGOT to the bibasic or pyrophosphoric acid. If the same temperature be kept up for fifteen minutes, the whole of the magnesia separates in the form of a powder which is quite insoluble in acids or water; when cold the mass is digested with water, which dissolves the phosphoric acid, leaving the phosphate of magnesia as a heavy, fine, snow-white powder, of a faint silky lustre. The filtered liquid is free from every trace of magnesia, and may be considered as pure phosphoric acid. If the bones contain chloride of sodium a trace of phosphate of soda will remain—in this case the burnt bones after being pulverized, should be boiled with water to remove the chloride. Dr. GREGORY recommends this process as a simple one for obtaining pure phosphoric acid. The phosphate of magnesia formed is a peculiar and anomalous salt. From six analyses Dr. GREGORY deduces the formula $2MgO+3P^2O^5$, that is, an acid sesquiphosphate of magnesia according to the older notions of phosphoric acid. It is insoluble in water or the acids, boiling nitric acid and aqua regia are almost entirely without action upon it. J. L. S.

20. *New Observation on the Chemico-dynamical action of Platinum;* by J. W. DOEBEREINER, (Annalen der Chem. und Pharm., Feb., 1845.)—Spongy platinum prepared in the ordinary way by heating the double chloride of platinum and ammonia, becomes ignited to redness when moistened with *formylic acid*, and decomposes it into carbonic acid and water, two atoms of oxygen being absorbed. It has no effect upon alcohol or pyroligneous spirit, except an alkali be mixed with them, then the sponge becomes incandescent, and the spirits are decomposed. So that by the presence of an alkali, the platinum sponge acquires the property possessed by platinum black, of absorbing oxygen largely.

J. L. S.

21. *On the quantitative determination of Soda, and its separation from Potash;* by Dr. WITTSTEIN, (Buckner's Report, xxxvi, 3, and Chemist, May, 1845, p. 215.)—The two bases are first converted into sulphates, then calcined, weighed, and the sulphuric acid found in them determined by a salt of baryta. On subtracting the acid from the saline mixture, the sum of the quantities of the two alkalies becomes known.

The quantity of *potash* may be ascertained, if we first subtract from the sum of the weight of the two salts, the product obtained by multiplying the weight of the sum of the two bases by the quotient, resulting from the division of the atomic weight of the sulphate of soda by the atomic weight of soda, and then dividing this by the difference resulting, on subtracting the quotient obtained by dividing the atomic weight of the sulphate of potash by the atomic weight of potash, from the quotient obtained, by dividing the atomic weight of sulphate of soda by the atomic weight of soda.

The amount of soda may be ascertained, if the sum of the weight of the two bases be multiplied by the quotient obtained on dividing the atomic weight of the sulphate of potash by the atomic weight of potash; and from the product thus obtained the weight of the two salts is subtracted, and what is left is divided just as in the case of the potash. It will be best understood when expressed in the following way:

K, the quantity of potash.
N, " soda.
S, " two salts.
b, " two bases.

q, quotient obtained by dividing the atomic weight of sulphate of potash by that of potash.

q', quotient obtained by dividing the atomic weight of sulphate of soda by that of soda.

Thus, $K=\frac{S-bq'}{q-q'}$; and $N=\frac{bq-S}{q-q'}$.

It is evident that q, q' and $q-q'$ are unchangeable quantities, q being equal to 1·84955, $q'=2·28209$, and $q-q'=-0·43254$. An example will render this much clearer. Let us suppose that the two sulphates weigh together 100 grains, the sulphuric acid (determined by baryta) 48 grains; consequently the two bases must weigh 52 grains. To find K, (the weight of the potash,) b (the weight of the two bases) $=52$ we multiply by $q'=2·28209$, and then subtract the product obtained $=118·66868$ from S (the weight of the two salts) $=100$, and divide the rest $=-18·66868$ by $q-q'=-0·43254$, by which 43·15 are obtained. These 43·15 of potash, to be converted into neutral sulphate of potash, will require 36·63 sulphuric acid. N (the weight of soda) can be ascertained by substituting the proper numbers for the letters in its formula, when it will be found to be 8·83, equivalent to 20·17 sulphate, which added to the sulphate of potash, furnish 99·95, the original amount being 100 grains.* J. L. S.

22. *Purifying Arseniferous Sulphuric Acid during its Manufacture;* by A. Dupasquier, (Compt. Rend., March, 1845, p. 794.)—In much of the sulphuric acid prepared from pyrites or from the sulphur obtained from pyrites, arsenic is present in the proportion of from 1 to 1½ thousandths. The author recommends the use of the alkaline sul-

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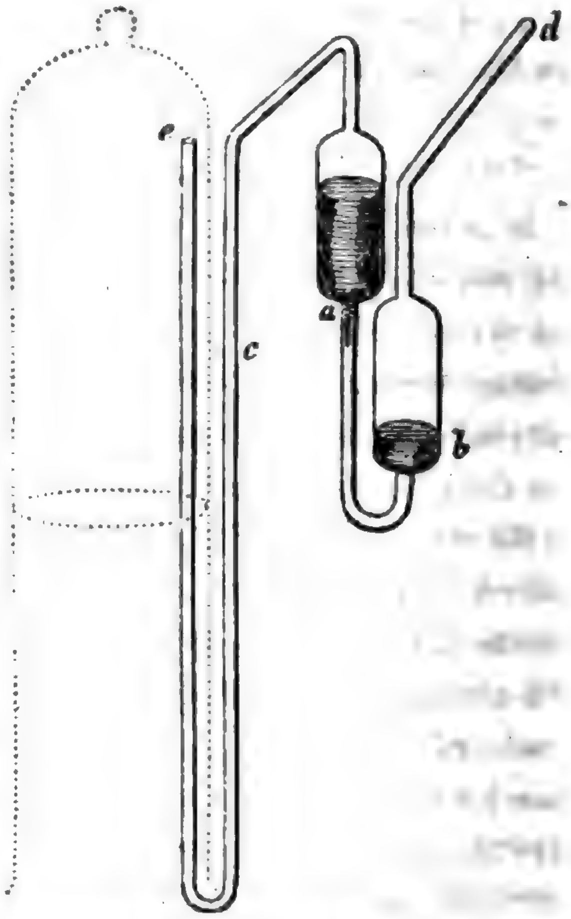
* This method I have found accurate and very easily performed; and if upon more extended experiments its accuracy be found to hold out, the analyst will require no better method. J. L. S.

phurets as a means of purification, (more especially the sulphuret of barium,) during the preparation of the acid. By this means also the nitric acid is necessarily destroyed, an acid occurring in most of the sulphuric acids of commerce. J. L. S.

23. *Observations on an Acid Rain;* by M. Ducres, (Journ. de Pharm., April, 1845.)—During the early part of June, 1842, a storm occurred in the town of Nismes, accompanied with much thunder and a large amount of hail. From some peculiarity in the taste of the hail, the author was led to examine it more closely. Having collected a quantity of it, and allowed it to melt, it was found to have an acid reaction, which upon examination was found to be due to nitric acid, formed no doubt by the action of electric fluid on the elements of the atmosphere. The occurrence of nitric acid in hail is not new, but the statement of this fact goes to confirm observations previously made. J. L. S.



24. *Gas Pipette;* by Dr. Ettling, (Ann. der Chem. und Pharm., Jan. 1845.)—This little instrument, easy of construction, will no doubt be found very serviceable for many purposes in the laboratory, as transferring gases from vessel to vessel without disturbing their position. Its construction and manner of operating is very readily understood by referring to the annexed figure. Previously to using the instrument, the extremity *e* is immersed in the liquid over which the gas has been collected, and the cylinder *a* filled by sucking at *d*, after which the branch *e* is passed beneath the receiver and the sucking continued, when the water will pass from *a* to *b*, and the gas from the receiver fill the cylinder *a*. It may now be transferred to another vessel by introducing the same branch and blowing in air at *d*. J. L. S.

25. *Iridescent Silver.*—(In a note from Prof. John Brockelsby of Trinity College, Hartford, Conn., to B. Silliman, Jr.)—It is well known to those who are conversant with optical phenomena, that the brilliant play of prismatic colors exhibited by mother of pearl is due to the structure of the surface; provided the shell is cut and polished in a particular manner. This interesting fact was announced to the scientific world in 1829 by the discoverer, Dr. Brewster, who

successfully transferred by pressure the splendid tints of the pearl to black wax, fusible metal, balsam of tolu, lead, tin, and various other substances. The colors displayed by fusible metal possess at first extraordinary beauty, which in a short time is partially lost, owing to a change that occurs upon the surface of the metal.

A few months ago, while engaged upon some experiments in electrotyping, I was led to think that by this process the hues of the pearl might be readily transferred to those metals, which from their hardness are incapable of receiving impressions in mass, but yet, on account of their freedom from oxidation, retain for a long time a surface comparatively pure. I therefore took a Smee's battery, which I had just constructed, and after several experiments succeeded in obtaining small sheets of silver, radiant with the hues of the shell. When seen by a single light, as that of a lamp, the play of colors is surpassingly beautiful, scarcely inferior to that of the pearl; and where equal care was employed, the plate of silver, which was formed eight months ago, rivals in brilliancy that which came fresh from the battery a few hours since.

The process by which this result is obtained is as follows. The first thing required is to prepare the shell. This is effected by grinding, and polishing it upon the back, in such a manner as to cut through the numerous concentric strata that compose its substance. When this is done, by the aid of a microscope the surface will be seen covered with delicate grooves, some thousand in an inch, formed by the sections of the concentric laminæ, and this configuration gives rise to the glowing tints of the shell. The next step is to obtain an exact impression of this surface upon some good conductor of electricity. This we are enabled to do by means of fusible metal, if proper precautions are employed in taking the impression. I pursue exactly the same method as in taking the copy of a medal. After fusing the metal, I pour it upon oiled paper, and when the air bubbles cease to rise through the metal the oxide is skimmed from its surface with a card, and as soon as it presents the appearance of a perfect mirror the shell is forced down upon it by a sudden pressure. When the metal has cooled I remove it from the shell, and having ascertained the accuracy of the impression, immediately plunge it, before any change of the surface can occur, into the silver solution, thereby completing the circuit between the poles of the battery. In a few moments the surface of the metal is frosted with silver, and the configuration of the shell exactly copied. A sheet of silver, of sufficient thickness to be easily removed with a pen-knife, will be deposited in the course of five or six hours under favorable circumstances. The battery I have employed consists of two plates of amalgamated zinc and one of platinized silver, six inches by eight.

The working mixture is sulphuric acid and water, the strength varying with the temperature, and the amount of work to be performed. I have found a wine-glass of acid to three quarts of well-water, at the temperature acquired by standing a few hours in a room at 70° Fah., to answer very well, when the surface to be plated did not exceed 1½ square inches. The silver solution is made by dissolving cyanide of potassium in water, and adding thereto the oxide of silver. The ratio of the ingredients I am unable to state, as I have not hitherto directed my attention to this point, but have prepared the solution by trial until I obtained the desired result.

By the process above described, we can at pleasure transfer the tints of the pearl to those pure metals, which will best preserve their brilliancy, and while the knowledge of this fact is interesting as a matter of science, it may perhaps be well for the artist to consider if it cannot be applied to some ornamental purpose, and the beauty of the precious metals enhanced, by teaching them to glow with the richest hues of light.

26. *On the Volumes of Atoms and their Relation to the Position of the Elements in the Electro-Chemical Series;* by M. Avogadro, (Bib. Univ. Genev. June, 1845, p. 182; from Mem. Acad. Roy. Turin, Vol. viii.)—The author gives the following table, and demonstrates that the order of the elements which it presents, is in general their order in the electro-chemical scale; and such discrepancies as appear, he believes will be removed when the molecular volume is more accurately determined.

NAMES OF SUBSTANCES.	MOLECULES, oxygen = 1*m*.	DENSITY, water = 1*d*.	VOLUME, molecular $\frac{m}{d}$.	VOLUME, molecular, gold = 1.
Chlorine,	0·55	1·40	0·395	0·612
Iodine,	1·98	4·95	0·399	0·618
Bromine,	1·22	3·00	0·407	0.632
Carbon, (diamond,)	1·50	3·50	0·429	0·665
Sulphur,	1·00	2·00	0·500	0·775
Phosphorus,	0·98	1·77	0·553	0·858
Palladium,	6·66	11·70	0·569	0·882
Platinum, Iridium,	12·33	21·50	0·573	0·889
Rhodium,	6·51	11·10	0·586	0·909
Osmium,	12·44	19·50	0·638	0·989
Gold,	12·43	19·26	0·645	1·000
Silver,	6·76	10·47		
Manganese,	6·29	8·01	0·785	1·218
Mercury, (solid,)	12·66	15·50	0·817	1·266
Arsenic,	4·70	5·75	0·817	1·267
Cobalt,	7·38	8·50	0·868	1·346
Nickel,	7·40	8·40	0·881	1·366
Iron,	6·78	7·60	0·892	1·382
Copper,	7·92	8·80	0·901	1·396
Tin,	7·35	7·29	1·008	1·563
Lead,	12·94	11·40	1·135	1·760
Zinc,	8·06	7·00	1·151	1·785
Potassium,	1·22	0·86	1·424	2·209
Sodium,	1·45	0·97	1·500	2·325

M. Avogadro has fixed upon 0·650 as expressing neutrality, or a state neither basic or acid, gold being the unit. He next deduces an *affinitary* number by taking the cube roots of the molecular volumes, which he finds to express the actual relations he had elsewhere determined for the elements, as regards the strength of their affinities. Thus $\sqrt[3]{0·65}=0·866$, will be the affinitary number of the neutrality point in the scale; $\sqrt[3]{2·209}=1·303$, the affinitary number for potassium; consequently $1·303-0·866=0·437$, is the distance of potassium from the point of neutrality. The following table contains his results; which however he considers as only approximations, that more accurate data will hereafter correct.

Names of substances.	Affinitary number, (gold = 1).	Affinitary number, (ox. = 1)	Names of substances.	Affinitary number, (gold = 1).	Affinitary number, (ox. = 1).
Oxygen,	0·214	1·00	Gold,	1·000	4·67
Chlorine,	0·819	3·97	Silver,		
Iodine,	0·852	3·98	Manganese,	1·063	4·99
Bromine,	0·859	4·01	Mercury,	1·082	5·06
Point of neutrality,	0·866	4·05	Arsenic,		
Carbon,	0·873	4·07	Cobalt,	1·104	5·16
Sulphur,	0·919	4·29	Nickel,	1·109	5·18
Phosphorus,	0·950	4·44	Iron,	1·114	5·21
Palladium,	0·959	4·48	Copper,	1·118	5·22
Platinum,	0·962	4·50	Tin,	1·161	5·43
Iridium,			Lead,	1·207	5·64
Rhodium,	0·969	4·53	Zinc,	1·213	5·67
Osmium,	0·996	4·65	Potassium,	1·303	6·09
			Sodium,	1·325	6·19

27. ***Connection between the constitution and boiling point of organic substances***; by M. S. Schröder, (Ann. de Chim. et de Phys. xiii, 1845, p. 145, from Ann. Pogg. lxii, p. 184.)—M. Schröder has deduced the following general laws:—

1. The molecular volumes of the equivalents of organic bodies are equal in the liquid state at equal distances from their point of ebullition; the volume of the compound is equal to the sum of the volumes of the constituent elements; these volumes are represented by entire numbers and have a simple relation.

Thus from the elementary composition and the point of ebullition, the density in the state of vapor may be determined; and reciprocally, knowing the elementary composition and the density of the vapor, the equivalent of a substance may be deduced.

2. The equivalents of volatile organic substances, generally adopted, and the equivalents of their elements, are too large compared with those of the metals and ought to be divided by 2.

The atomic weights of most metals are consequently double what they should be compared with those of oxygen, hydrogen, carbon, nitrogen, sulphur, chlorine, bromine, iodine, as Gerhardt endeavored to demonstrate.

3. The density of the vapor of a substance or its equivalent being given, as also the elementary composition and point of ebullition, the nature of its constituent parts may be determined, provided the compound does not include components which have not been isolated, and whose influence upon the point of ebullition has not been ascertained.

4. Reciprocally, from the composition, we may deduce—1, the equivalent; 2, the density of its vapor; 3, the density in the liquid state; 4, its point of ebullition.

These several laws are illustrated by numerous examples, and the influence of different radicals on the boiling point given. Thus water of "hydratation" ($H^4 O^2$) raises the point of ebullition of a substance 113·5° C. The oxyd of carbon ($C^2 O^2$), 57°; carbonic acid ($C^2 O^4$), 90°; formyle ($C^4 H^4$), 52°; methylene $(C^2 H^4)^m$, 21°; $(C^2 H^4)^e$, 17°; and hydrogen (H^4) diminishes the temperature of ebullition 3°.

Benzine ($C^{12} H^{12}$) boils at 86°, MITSCHERLICH.

Retinaphtha ($C^{14} H^{16}$) boils at 108°, WATER.

Retinaphtha consists of methylene and benzine; the point of ebullition should therefore be 21°; and observation gives 22°.

Ether ($C^8 H^{20} O^2$) boils at 35·7°, GAY LUSSAC.

Carbonic ether boils at 125° to 126°, ETTLING.

The point of ebullition, as above given, ought to be 90° greater for carbonic ether than for ether, and so it is.

Oxalic ether ($C^{12} H^{20} O^8$) boils at 183° to 184° C., DUMAS and BOULLAY. And as it differs from carbonic ether in the addition of oxyd of carbon ($C^2 O^2$), the point of ebullition should be raised 57° and observation gives 57° to 58°.

To determine the point of ebullition of Tetramethylene $(C^2 H^4)^m_4$ *from that of Benzine, that is, from triformyle* $(C^4 H^4)^3$.—Formyle raises the boiling point 52°; consequently triformyle will raise it 52×3=156°; methylene raises it 21°; and tetramethylene consequently 21×4=84°.

The boiling point of benzine is 86°; now if benzine, which raises the temperature 156°, has for its boiling point 86°, which is 70° less than 156°, then tetramethylene, which raises the temperature 84°, will have for its boiling point 14°, which is 70 less than 84°. M. BOUCHARDAT has obtained a carburet of hydrogen ($C^8 H^{16}$) which boils at 14·5°, and he has called it *Caoutchène.* This carburet is no other than tetramethylene.

Alcohol=($C^4 H^{12} O^2$), or is a hydrate of bielayle $(C^2 H^4)^e_2$ ($H^4 O^2$); it boils at 78·4°. The number representing the influence of its component parts is 2×17=34° for bielayle; and 113·5° for water; the sum equals 147·5°. Subtracting 78·4°, the boiling point of alcohol, we obtain 69·1°. We find now the boiling point of benzine or triformyle by subtracting 69·1° from 3×52=156°, which represents the influence of triformyle. We thus obtain 87°; observation gives 86°.

The author goes on to give the calculated and observed boiling points for a great variety of substances, and with those whose composition is fully understood, the results corroborate throughout his most remarkable deductions.

28. *Contraction of Ice in Cooling*, (Ann. de Chim. et de Phys., 3d series, xiv, 1845, p. 369.)—M. BRUNNER, by a series of experiments, has shown that, contrary to the observations of M. PETZHOLDT, ice contracts by cold. He obtained the following as the amount of linear contraction for 1 degree of Centigrade, by three methods—·0000416, ·0000315, ·0000395; from which is deduced the mean ·0000375 or $\frac{1}{26700}$. This is equivalent to ·00002083 for a degree of FAHRENHEIT. The contraction of ice consequent upon a diminution of temperature, is greater than that of any other solid body hitherto examined. The following table gives the density at different Centigrade temperatures.

Temperature.	Density of Ice.	Temperature.	Density of Ice.	Temperature.	Density of Ice.
0° C.	0·91800	— 7° C.	0·91879	—14° C.	0·91957
—1	0·91812	— 8	0·91890	—15	0·91968
—2	0·91823	— 9	0·91901	—16	0·91980
—3	0·91834	—10	0·91912	—17	0·91991
—4	0·91845	—11	0·91924	—18	0·92002
—5	0·91856	—12	0·91935	—19	0·92013
—6	0·91868	—13	0·91946	—20	0·92025

Just the reverse is the case with water, which continues to *dilate* by increase of cold, as shown by M. DESPRETZ, whose experiments were carried to —20° C., (—4° F.)

29. *Transparency of Quicksilver*, (L'Institut, No. 605, p. 279.)—M. MELSENS has found that quicksilver in minute globules is transparent and transmits a blue light, slightly tinged with violet. These globules are formed when a fine stream of water is dropped on a mercury bath; the drops of water, in consequence of falling with some force, become covered with a thin pellicle of mercury, which present the fact here stated. The result has been verified by ARAGO.

30. *On Wax*; by M. B. LEWY, (extracted from M. LEWY's memoir, Ann. de Chim. et de Phys. xiii, 1845, p. 438.)—Beeswax is changed completely into a soluble soap when treated with a very concentrated solution of potash.

Treating wax with boiling alcohol, dissolves out the *cerine*, which on cooling is deposited in fine needles. On evaporating the alcohol after filtration, another compound is obtained, called *ceroleine*. Ceroleine is very soft, melts at 83·5° F., is very soluble in cold alcohol and ether; it constitutes 4 to 5 per cent. of the wax.

From the soap obtained with potash, muriatic acid separates an acid named *cerinic acid*; it is white and crystallizable.

A vegetable wax is obtained in China from a Rhus (*R. succedaneum*,) which requires a temperature of 180° F. for fusion. It is but slightly soluble in boiling alcohol or ether, but completely so in naphtha. With a lye of potash it forms a soluble soap; it also combines with baryta.

The *Palm wax* from New Grenada is obtained from the *Ceroxylon andicola.* The scrapings from the exterior of the tree are boiled by the Indians, and the wax swims on the surface of the water. After being purified, it has a yellowish white color and fuses at 161½° F.; it is but slightly soluble in boiling alcohol.

Other kinds of wax of vegetable origin are, the wax of the *Myrica cerifera;* of *Carnauba*, derived from a palm in northern Brazil; of *Ocuba*, from a tree in the provinces of Para and Guyana, and afforded by a species of *Myristica* (either the *M. ocoba*, *officinalis*, or *sebifera;*) of *Bicuiba*, derived from the *Myristica bicuhyba*, according to Brongniart; of *Sugar-cane;* and of *Andaquies* from the upper regions of the Oronoco and Amazon east of the Cordilleras. Of each of these varieties, analyses are given by M. B. Lewy. He concludes by expressing his doubts with regard to the experiments of Milne Edwards and Dumas upon the animal origin of beeswax, and sustains the view that it is collected by the bees.

31. *Organic Compounds*, (L'Institut, 1845, xiii, p. 333.)—M. Laurent has arrived at the conclusion, after numerous analyses and comparisons, that in all the organic compounds, the sum of the atoms of nitrogen and hydrogen (or of the bodies which may replace hydrogen, such as the halogen bodies and the metals) is always divisible by *four.*

32. *Analysis of a Chinese Metallic Mirror*, (L'Institut, 1845, p. 332, from Erdmann's Jour. 1845, No. 8.)—M. Elsner obtained by his analysis the following results:—

	I.	II.
Copper,	80·823	80·850
Lead,	9·389	10·038
Antimony,	8·431=98·643	8·430=99·318

The mirror was a very perfect one, and was scarcely at all tarnished. It afforded a trace of iron but no arsenic. He suggests as probable, that in preparing the alloy equal parts of lead and antimony were employed, but that a part of the antimony was volatilized during the fusion.

33. *Air of Mines*, (L'Institut, No. 603, 1845, p. 255.)—M. Leblanc, on analyzing the air of Poullavuen mine, finds that when most altered by respiration and combustion of lamps, there is 3 to 4 per cent. of carbonic acid, and a diminution of 4 to 5 per cent. in the proportion of oxygen. The miners' lamps are extinguished; but by placing the meshes of two lamps in contact, combustion often goes on where one

alone fails. The respiration of the miners is a little impeded, but work is possible when this limit is not exceeded, provided the temperature is low. Air collected at Huelgoet, in an unoccupied shaft, showed a diminution of 10 per cent. in the amount of oxygen, without a replacement of the same by carbonic acid, which circumstance he attributes to the influence of decomposing pyrites.

34. *Bezoardic acid.*—This acid according to Wöhler, is identical with the ellagic acid of Braconnot.

35. *Litharge*, (L'Institut, No. 605, p. 276.)—M. F. Leblanc has determined that oxygen will dissolve in litharge in fusion, in the same manner as in silver, without forming a superoxyd ; also that nitrogen probably dissolves in a feeble proportion in the same manner. He concludes also that litharge and red lead differ only physically in structure, color and density, but not in composition.

II. Mineralogy and Geology.

36. *Cancrinite, Nepheline, and Zircon, from Litchfield, Maine ;* by Dr. C. T. Jackson, (from the report in the Proceedings of the Geol. Assoc., for 1845.)—The Cancrinite was found by Mr. Stacy, in boulders in granite, associated with Zircon and Nepheline. The masses are an inch or more in diameter, with some indications of a rhombohedral cleavage. They are translucent, with a deep azure blue color. Hardness=6 ; specific gravity=2·420—2·462. The mineral gelatinizes in acids quickly. Before the blowpipe it loses its color, becoming transparent below a red heat; and at a red heat it melts to a colorless glass.

The Nepheline occurs occasionally in six-sided prisms of a lemon or sulphur yellow color, with a vitreous lustre inclining to resinous ; also in masses with a somewhat oily lustre and a greenish yellow color, (variety Elæolite.) The crystals have the specific gravity 2·42, and the Elæolite variety, 2.442. The hardness is 5 to 5·5.

The following are the analyses of these minerals, by Dr. Jackson :

	Cancrinite.		Nepheline.
Silica,	35·400		34·700
Alumina,	31·750		28·000
Soda,	17.578		13·360
Sulphuric acid,	6.460		
Oxyd of Manganese,	4·397	Oxyd of manganese and of tungsten ?	3·700
Magnesia,	1·800		2·800
Lime,	1·856		8·440
Water,	0·875		

In the analysis of the Cancrinite, if the sulphuric acid be regarded as sulphur, it will amount only to 2·592 per cent., and indicates a loss of 3·752 per cent. Dr. Jackson states that it is probable that a portion of the sulphur must be in a state of sulphuric acid, while another portion combined with sodium and alumina probably gives the rich blue color to the mineral. The analysis differs essentially from that in Poggendorf's Annalen, xlvii, p. 179, in the occurrence of sulphur and sulphuric acid in place of carbonic acid. Dr. Jackson consequently analyzed a specimen of the foreign mineral so far as to ascertain that no carbonic acid exists in it, and that it does contain sulphur and sulphuric acid.

The crystals of *Zircon* are short prisms, sometimes highly modified. One crystal found by Mr. Stacy, was a little more than one inch in diameter.

37. *Iberite, a new mineral from Montalvan, province of Toledo, Spain;* by E. C. Norlin, (Bib. Univ. Geneva, July, 1845, p. 375; from Compt. Rend. Acad. Stockholm.)—This mineral occurs in large hexagonal prisms and is near Gigantolite. It has both lateral and a basal cleavage; hardness 2·5; specific gravity 2·89; fracture scaly; color pale grayish-green; opaque, with a lustre between pearly and vitreous. Exposed to the blowpipe it melts at a strong heat and fuses perfectly into a glass; and in a tube it gives off water. Composition, according to M. Norlin, silica 40·901, alumina 30·741, protoxyd of iron 15·467, potash 4·571, soda 0·043, protoxyd of manganese 1·327, lime 0·397, magnesia 0·806, water 5·567=99·820; from this he deduces the formula

$$(\dot{\mathrm{F}}\mathrm{e},\ \dot{\mathrm{K}})^3\,\dddot{\mathrm{S}}\mathrm{i}+\dddot{\mathrm{A}}\mathrm{l}^2\,\dddot{\mathrm{S}}\mathrm{i}+3\dot{\mathbf{H}}.$$

Amphodelite has the same formula, exclusive of the water.

38. *Damourite, a new mineral*, by M. Delesse, (L'Institut, No. 605.)—Damourite is a hydrosilicate of alumina, having the formula, according to Delesse, $\dddot{\mathrm{S}}\mathrm{i}\,\dot{\mathrm{K}}+3\dddot{\mathrm{S}}\mathrm{i}\,\dddot{\mathbf{A}}\mathrm{l}+2\dot{\mathbf{H}}$. It occurs in small lamellar crystals, having a pearly lustre, and a little harder than talc. Its specific gravity is between 2·74 and 2·82. Before the blowpipe it melts with difficulty to a white enamel, not acted upon by muriatic acid or aqua regia; it is completely attacked by sulphuric acid.

39. *Diaspore*, (L'Institut, No. 605.)—Damour finds that this mineral is attacked by acids after being strongly calcined, and has thus analyzed it. His results were the same with those of Berzelius and Dufrenoy.

40. *Native Lead.*—Native lead has been detected in the carboniferous limestone near Kenmar, County of Kerry, Ireland. It occurs in grains in crevices in the rock, and fragments weighing half an ounce are said to have been obtained. This mineral is said also to occur in the chain of Luquillo, at Porto Rico.

41. *Crystallization of Sulphuret of Cadmium and Perowskite;* by M. Descloiseaux, (Ann. de Chim. et de Phys., xiii, 1845.)—The form is a hexagonal prism terminating in the faces of one or more six-sided pyramids, and with a truncate summit. Descloiseaux has determined

the relation between the vertical and a lateral axis to be as 689 : 418. The inclination of P or the terminal plane, on the four faces in succession, observed between P and M, (a lateral plane of the prism,) are as follows:—$P : b^2 = 154° 33'$, (154° 32′ observed by Breithaupt;) $P : b^1$, 136° 25′ (136° 23′, by Breithaupt;) $P : b\frac{1}{2} = 117° 43'$; $P : b\frac{1}{4} = 122° 9\frac{1}{2}'$.

Perowskite is a titanate of lime, from the Ural, and occurs in modified cubes. Descloiseaux figures a very complex crystal with 7 planes on each edge, and 10 on each angle, or 164 faces in all. The modifications are in part hemihedral.

42. *Baryto-calcite;* MM. Descloiseaux and Dumas, (Ann. de Chim. et de Phys., xiii, 1845, p. 425.)—This mineral assumes two distinct forms, one an oblique rhombic prism and the other a right rhombic; the former is from Alston Moor, and the latter from Fallowfield. Analyses by Descloiseaux and Dumas confirm the view that they are identical in composition; the formula is $\ddot{C}\,\dot{B}a + \ddot{C}\,\dot{C}a$.

43. *Fluids and Crystals in Topaz*, by Sir David Brewster.—These crystals and fluids, occupying cavities in topaz crystals, have been found to be of various kinds. The crystals present the following different forms. Cube, cube with truncated edges and angles, rhombohedron, prism with plain and pyramidal summits, rhomboidal plates, hexagonal plates, and long rectangular plates; and Sir David has determined that there are two distinct substances under a tesseral form, and three others among the remaining forms. They are operated upon very differently by heat, some dissolving easily and others not at all.

The fluids are of two kinds, one dense and the other light and volatile. By heat they sometimes made their way out of a cavity between the laminæ to some other resting place or to the surface, the laminæ closing together after the passage of the fluid.

44. *Phacolite observed in New York*, (communicated by Mr. Alger.)—Mr. Alger has detected this mineral among specimens of minerals received from Messrs. Matthews and Johnson, of New York city. It was labelled stilbite, but proves on examination to be *phacolite.* It occurs in geodes, the crystals implanted on calc spar, and associated with silvery mica, and a few scales of specular iron. They are of a wax or honey-yellow color and a waxy lustre, translucent and brittle. It is extremely scarce.

45. *Yttro-cerite*, (ib.)—This rare mineral has been found by Mr. Alger associated with Brucite, in masses of rolled limestone from the town of Amity, Orange County, N. Y.

46. *Dysluite identical with Automolite*, (ib.)—Mr. Alger states that from recent observations of the New Jersey specimens, he is satisfied there is no reason for any longer considering the two minerals distinct.

The characteristic differences heretofore insisted on in color, hardness, specific gravity, &c. being well accounted for by the isomorphous replacement of alumina and peroxide of iron, and protoxide of iron and zinc. This opinion is confirmed by the following comparison of compositions, according to the analysis of automolite by Eckeberg and Abich.

	Dysluite.		Ox. Ratio.		Automolite.	Ox. Ratio.
Alumina,	30·49	14·23	20·51=3	Alumina,	57·09	25·37=3
Perox. Iron,	30·00	6·00		Oxide Zinc,	34·80	7·42=1
Protox. Iron,	11·93	2·65	7·53=1	Magnesia,	2·22	
Protox. Mang.	7·60	1·68		Protox. Iron,	4·55	
Oxide Zinc,	16·80	3·20	Thomson.			Abich and Eckeberg.

To confirm this probable view, a new analysis of dysluite is required, to show the iron to be protoxide, as Dr. Thomson, (the only chemist who has analyzed this mineral,) states it to be peroxide.

47. *Acadiolite of Nova Scotia*, (*Chabasite.*)—Mr. A. A. Hayes, of Roxbury Laboratory, analyzed this mineral for Mr. Alger's edition of Phillips' Mineralogy. As the analysis has not before been published in this Journal, we annex it.

	I.	II.
Silica, -	52·02	52·20
Alumina, -	17·88	18·27
Lime, -	4·24	6·58
Potash, -	3·03	2·12
Soda, -	4·07	
Water, -	18·30=99.54 Hayes.	20·52=99·69 Hayes.

These results agree closely with those obtained by Hoffmann, and prove the identity of this mineral with chabasite, although Rammelsberg has given a somewhat different formula for the two.

48. ***Washingtonite of Shepard.***—This mineral was analyzed by Mr. J. L. Kendall, under the direction of Dr. C. T. Jackson, (also for Mr. Alger's book,) and gave the following result:

		Ratio of Ox.
Titanic acid, - - -	25·28	1
Peroxide of iron, - - -	51·84	2
Protoxide of iron, - - -	22.86=99·98	1

The identity of this mineral with an Ilmenite from Arendal, analyzed by Mosander, cannot be questioned, thus:

			Ratio of Ox.
Ilmenite of Arendal by Mosander,—	Titanic acid,	24·19	1
	Perox. iron,	53·01	2
	Protox. iron,	19·91	1
	Mag. and lime,	1·01	

49. ***Mexican Fossils***, (cited from Ann. Mag. Nat. Hist. xvi, 1845, p. 212.)—In a letter to Prof. Bronn, M. Claussen states that he has again

found in Brazil a great many fossil bones, and among them the head of a large tiger related to *Felis meganthereon* (*Ursus cultridens*), but it is much larger; the upper canine teeth are nearly 10 inches long and 1½ broad. The French Institute has purchased it for 4000 francs. The remainder of the collection, except the duplicates, has been disposed of to the British Museum. He promises subsequently to communicate some remarks on the occurrence of these fossil bones, and especially on that of the human remains, which are found among the bones of various extinct animals. He has discovered two kinds of *monkeys*, which approximate to the genera *Mycetes* and *Cebus*. A short time since also, among a number of pieces of amber (not copal), he found some containing insects, in which distinct spiders' webs could be seen (thus fossil spiders' webs!!); in some, the webs and also the insects hanging in them were evident.

50. *The Oust-Urt, and shores of Lake Aral;* (L'Institut, 605, p. 256.)—This region hitherto little known, has been geologically examined by M. S. de HELMERSEN. He has ascertained, that at the period when the beds of the Oust-Urt were deposited, the Caspian and Aral seas formed a single Mediterranean sea; that at the middle of this sea stood a high island—the Oust-Urt—at whose foot commence formations of marl and sandy clays, in which marine and fresh-water fossils are mingled; that the two seas communicated with one another for a period by a channel, and had a common fauna even to the formation of the most recent deposits, which include some existing species.

51. *Infusoria.*—EHRENBERG has arrived at some remarkable results with regard to the prevalence of infusoria in volcanic rocks. They are as follows:—

Numerous and widely extended observations have proved that there is an ultimate reciprocal relation between independent infusorial life and the volcanic phenomena exhibited upon the banks of the Rhine. Volcanic crystals of sodalite, leucite, and probably of augite, consist in part of masses of infusoria.

The volcanic island of Ascension, so destitute of life, animal and vegetable, and even of streams of water, and situated in mid-ocean, presents an enormous mass of volcanic cinders which consist almost wholly of organic matters, principally of fibres of plants, along with some *fresh-water* siliceous infusoria.

Although observation shows that in all parts of the world the infusoria, prevalent in volcanic rocks, are of *fresh-water* origin, still Patagonia affords *marine* deposits, constituting masses of great thickness.

The Pyrobiolitic rocks in Patagonia constitute extensive beds 800 feet thick, containing no carbonate of lime, and only here and there a little sulphate of lime.

The cinders which have been ejected by Pompeii, are of fresh-water formation; and they are similar to those constituting the tufa of Hochsimmer, on the Rhine.

The bed containing the fossil Mastodon, on the La Plata, and that of the fossil bones at Monte Hermosa, and the hills in the plains of Bahia Blanca, are formations of fresh-water origin, mixed with some marine.

52. *Abundant occurrence of rare Infusoria in the Scallop.*—(To the Editors of the Annals of Natural History.)—GENTLEMEN: The discovery some time since of the siliceous shells and cases of animalcules in the stomach of recent *Lepades*, belonging to many of the genera and some of the species which constitute a large proportion of the miocene tertiary strata of Virginia, was announced in Dr. MANTELL's recent work, the 'Medals of Creation.' (See vol. i, p. 586.) This fact, so highly interesting in a geological point of view, has been fully established by many; and among others by the Rev. J. B. READE, who has communicated the result of his examination of the oyster to the Microscopic Society. Having subsequently extended my investigations to the contents of the digestive sac of other mollusks, it may interest your readers to be informed that the common scallop (*Pecten maximus*) now in season, and therefore easily obtained, contains a richer assemblage of the most beautiful siliceous carapaces of animalcules than any other of the mollusca hitherto noticed.

So abundant and diversified are these forms in the scallop, that a few grains of the undigested contents of the stomach, properly prepared and mounted on a glass slide, exhibits many of the species usually found in the Richmond earth, and indeed could not be readily distinguished from a similar preparation of the fossil forms.

Another remarkable fact, also noticed in the 'Medals,' (see p. 233,) that of the occurrence of the mineralized bodies of Polythalamia, is fully confirmed; and when the eye of the observer becomes accustomed to the appearances presented by remains of this kind, they will be found abundantly in most chalk flints. I discovered one species in an atom of flint, in which the entire body of a *Rotalia*, except that part of it which occupied the outer cell, is as beautifully preserved as that of an insect in amber.

I am, gentlemen, yours obediently, HAMLIN LEE.

Chester Square, Pimlico, April 21, 1845.

53. *On the Microscopic Constituents of the Ash of Fossil Coal;* by Professor EHRENBERG, (Ann. Mag. Nat. Hist., xvi, 1845, pp. 69, 70.)—At the meeting of the Berlin Academy of the 25th of October, Prof. EHRENBERG communicated an observation of Dr. FRANZ SHULZ of Eldena, which the latter had addressed to M. v. HUMBOLDT in a letter, in which he describes his method of separating the silica contained in coal so chemically pure as to enable us to recognize the microscopical

siliceous organisms. "The usual method of burning the coal," Dr. Schulz states, "is attended with an unavoidable vitrification of the mineral constituents, even when conducted in the slowest and most cautious manner, owing to which their cellular structure is lost. After many fruitless experiments I succeeded in hitting upon a method of incineration, which leaves the silica contained in the coal perfectly unaltered. Very instructive preparations are readily obtained (from the already known structural relations of siliceous earth in plants) on moistening grass-halms, ears of grain, *Equisetum*, Spanish cane, &c. with nitric acid, and afterwards burning them on platinum foil. The nitric acid not only facilitates the combustion of the organic substance, but also prevents the potash combined with the vegetable acid from being converted into carbonate of potash before the silica has been heated to such a degree as to be less liable to be acted upon. The greater degree of heat required for the perfect combustion of the coal no longer destroys the cellular form of the silica after nitric acid has prevented the production of carbonate of potash on the first application of heat. An excess of nitric acid has the effect of destroying the connexion of the siliceous cells and acts too powerfully upon them, and should therefore be avoided.

"Encouraged by the success of these experiments, I turned my attention to coal, it being exceedingly desirable to be enabled to detect remains of organic structure in it. The large quantity of siliceous earth contained in all varieties of coal led me to infer that a judicious method of incineration would be attended with good results; your excellency will be enabled to judge from the preparation attached in how far I have succeeded. A piece of coal of about two square inches was broken into twelve pieces of nearly the same size, and then treated with nitric acid in a platinum vessel. The nitric acid being evaporated at a moderate heat, I ignited the residue until no further empyreumatic vapors were given off, treated the residue again with nitric acid and repeated the ignition. Thus prepared, the coal was placed in a platinum crucible with a lid perforated in the centre, and air was blown from a gasometer through the aperture in the lid, whilst the crucible was kept at a red heat over a spirit-lamp, so that the coal was necessarily slowly consumed. The ash thus obtained had not coked, but formed a brownish powder. Some white splinters occur among this, which appear on microscopical examination to be aggregated siliceous cells arranged in regular succession, of the structure of the prosenchymatous cells of wood."

Prof. Ehrenberg added, that the importance of a method for obtaining the organized siliceous parts from the lower strata of the earth with their forms preserved for microscopical observation is manifest, and requires no recommendation, to judge from the results which have already ensued. His own efforts with respect to coal had never been attended with success, and he therefore considers this method as a most useful and important discovery. He further stated that the clearness of the specimens (which were, it was to be regretted, not numerous) communicated by M. Schulz had astonished him, and, as might have been expected, had immediately been attended with a result. Prof. Ehrenberg had during many years brought before the Academy descriptions of the parts of plants (containing silica) which are found in marshy soils of all zones and in the infusorial deposits, and had likewise alluded to their origin from recent plants. This group, called *Phytolitharia*, had been as it were classified by him into eleven genera. Of these eleven genera only one is found in several forms in the purified siliceous ash of the coal forwarded by M. Schulz, namely the genus *Lithostylidium*, which contains regular siliceous nuclei of cells of plants. *Lithodontia*, or marginal teeth of grasses, *Lithodermatia*, or epidermis of plants (*Equisetacea Arundinacea*), could not be distinctly recognized, although the presence of the latter may be presumed. Other negative results were also particularly remarkable, namely the absence of all *Lithasterisci*, *Lithosphæræ*, *Spongolites*, &c. &c., otherwise so frequent. Finally, no trace of infusoria possessing a siliceous shell was found, notwithstanding the most careful investigation.

He concluded by expressing a conviction that a rapid development of our knowledge on this subject would, now that a method had been discovered, undoubtedly take place, and a wish that this may be the commencement of its study.

54. *On some New Species of American Desmidiaceæ, from the Catskill Mountains;* by J. W. Bailey.—During the month of August, 1845, I collected from the ponds near the Catskill Mountain House, a portion of the sediment adhering to various submerged bodies, and on submitting it to microscopic examination, I found it unusually rich in interesting organisms. Among these were some which appeared to me to be so novel and interesting, as to merit being placed on record by at least the following brief notice.

Fig. 1.

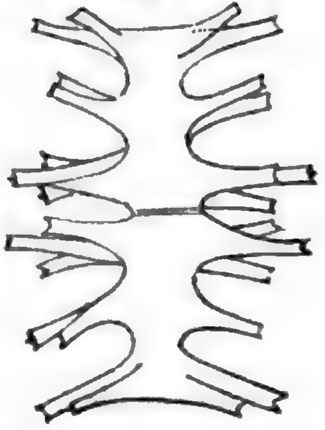
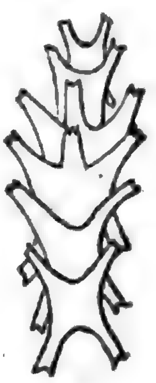


Fig. 2.



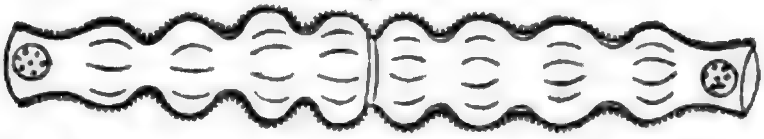
1. *Euastrum muricatum*, (figs. 1 and 2.) Body binary, each half divided by deep indentations into three transverse portions, of which the one nearest the middle has six projecting arms, (three on a side,) and the other two have each four arms, (two on a side.)

This is one of the most remarkable species of *Euastrum* which I have yet seen, and is at once distinguished from all known species by its numerous arms or projections, of which those belonging to each principal subdivision are not arranged as usual in the general plane of the body, but one above another in the plane perpendicular to the broadest surface to the individual. These arms much resemble those of *Xanthidium Arctiscon*, EHR., and terminate in a similar manner in three or four diverging points. Its size is equal to the largest of the genus. It is rather rare in the Catskill Ponds.

Fig. 1 gives the front view, and fig. 2 an oblique view of the body thrown up on edge.

2. *Closterium nodosum*, (fig. 3.) Body binary, straight, somewhat cylindrical, each half having four prominent nodes.

Fig. 3.



This species is easily recognized by the deep indentations in its outline, corresponding to the constrictions which separate the transverse rows of knot-like projections. The clusters of moving corpuscles are near the extremities. When highly magnified, the outline shows something resembling minute pubescence. It is one of the largest species of the genus. I found vast numbers of this species in the Catskill Ponds, all agreeing with the above description.

Fig. 4.

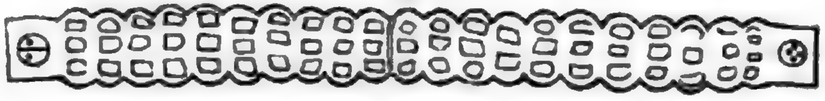


Fig. 5.

3. *Closterium verrucosum*, (fig. 4.) Body binary, straight, cylindrical, with numerous transverse rows of small prominences. Moving corpuscles near the extremities. This is a pretty species, with a waved outline caused by the slight projections, which are arranged in numerous transverse rings. It is quite abundant with the preceding in the Catskill Ponds.

The detection of the above forms gives reason to hope, that other species equally curious may be found when the productions of other sub-alpine ponds are examined.

N. B. The figures which accompany this notice are drawn to the scale which is represented by fig. 5. This shows $\frac{10}{100}$ of a millimetre magnified equally with the drawings, which are much less amplified than those given in the plates of the American *Bacillaria*.

III. ZOOLOGY.

55. *The Blood-Corpuscle considered in its different phases of development in the Animal Series;* by THOS. WHARTON JONES, Esq., F. R. S., lecturer on Anatomy, Physiology and Pathology, at the Charing Cross Hospital, (Roy. Soc. June, 1845.—Ann. Mag. Nat. Hist. xvi, 1845, 131.)—This paper is divided into three parts; the first relating to the blood-corpuscles of the Vertebrata; the second to those of the Invertebrata; and the last to a comparison between the two. He first describes the microscopic appearances of these corpuscles in different classes of vertebrate animals, beginning with the skate and the frog, and proceeding to birds and mammifera; first in their early embryonic state, and next in the subsequent periods of their growth. He finds in oviparous vertebrata generally, four principal forms of corpuscles. These he distinguishes as the phases, first of the *granule blood-cell*, which he describes as a cell filled with granules, disclosing by the solvent action of dilute acetic acid on these granules a vesicular, or as the author terms it, a "*cellæform*" nucleus. These granule cells appear under two stages of development, namely, the coarsely granulous stage and the finely granulous stage. The second phase is that of the *nucleolated blood-cell*, oval in shape, containing a vesicular (or "cellæform") nucleus, and red-colored matter. These cells likewise appear under two stages of development; colorless in the first and colored in the second, in which last stage it constitutes the *red corpuscle.* In the early mammiferous embryo, he finds, in addition to the former, a third phase, that of *free vesicular nucleus*, exhibiting, like the nucleolated cell, the colorless and the colored stages.

On examining the corpuscles of the lymph of vertebrate animals, the author finds them in all the classes to be identical in structure with their blood-corpuscles, and differing only in the inferior degree of coloration, attending their last stage. In the oviparous classes, he observes that the nucleolated are more numerous than the granule cells, while in the mammifera the latter are predominant, which is the reverse of the proportion in which they exist in the blood of these animals. He finds that some of the nucleolated cells of the contents of the thoracic duct exhibit a marked degree of coloration, and have an oval shape; thus offering a resemblance with the blood of the early embryonic state.

The blood-corpuscles of all the invertebrate animals in which the author examined them, present the same phases of granule and nucleolated cells as in the higher classes, excepting that in the last stage of the latter phase the coloration is very slight, but the vesicular nucleus is frequently distinctly colored. As in the higher classes, corpuscles exist in different states of transition from the granular to the nucleolated form of cell. In some of the invertebrata, corpuscles are found which appear to be the nuclei of some of the nucleolated cells become free ; and these the author considers to be abortions, rather than examples, of cells having attained their third phase of free cells. Corpuscles are also met with in these animals, in greater or less abundance, belonging to the lowest forms of organic elements, namely, elementary granules.

The comparison which the author institutes between the blood-corpuscles of the vertebrate and invertebrate divisions of the animal kingdom, tends to show that they in all cases pass through similar phases of development, except with respect to the last, or colored stage of the nucleolated cell, which they do not attain in the lower classes of animals. He finds that the blood-corpuscles of the crab, according to an analysis made by Professor GRAHAM, contain a sensible quantity of iron, perhaps as much as red corpuscles. He considers the corpuscles of the blood of the invertebrata, in as far as relates to the absence of nucleolated cells, as resembling those of the lymph of vertebrate animals.

56. *On the Extinct Mammals of Australia, with Additional Observations on the genus Dinornis of New Zealand ;* by Professor OWEN, (Mag. Nat. Hist. xvi, 1845, p. 142.)—In a previous report Professor OWEN had demonstrated the former existence in Australia of two genera of Marsupial animals, rivalling in size the rhinoceros and hippopotamus of the old continent. Since the reading of his first report, Prof. OWEN had received three molar teeth belonging to the upper jaw of the *Diprotodon ;* the crown of each tooth was divided into two principal transverse ridges, like those of the lower jaw, and the enamel presented the wrinkled and punctate surface peculiar to the genus. With these was found a large scalpriform incisor, whose bevelled cutting edge showed that it worked upon a similar tooth in the lower jaw. The *Diprotodon*, therefore, had molars like the kangaroo ; but, instead of the two large incisors in the lower jaw being opposed to six smaller in the upper, as in the kangaroo, it had two large incisors above as well as below, agreeing in form and structure, and relative size, with those of the Wombat. Prof. OWEN considered himself justified in concluding that the *Diprotodon* combined the characters of *Phascolomys* with those of *Macropus*, exhibiting both upon a gigantic scale, and constituting one of those links in the chain of being which the course of time has broken and destroyed. Prof. OWEN also stated that a large collection of bones of the Dinornis had been obtained from a new locality by Mr. PERCY EARLE. This collection contains four of the species of Dinornis already described, including the three most remarkable for gigantic stature. One of these, with a stature nearly equalling the ostrich, presents in all the bones of its leg double the thickness in pro-

portion to their length, and must have been the strongest and most robust bird in proportion to its size that ever existed. Of the gigantic species, vertebræ, ribs, and an almost entire sternum, most resembling that of the Apteryx, have been obtained. The Rev. Mr. Williams has also transmitted the cranial portion of a skull related in size to the *Dinornis struthoïdes*, manifesting many peculiarities and a striking resemblance to the same part in the Dodo and Apteryx.

57. *On the Boring Apparatus of the Carnivorous Gasteropods, and of the Stone and Wood-burrowing Bivalves;* by Albany Hancock, Esq., (Mag. Nat. Hist., xv, 1845, p. 113.)—During the investigation of the anatomy of the *Eolidæ* by Dr. Embleton and myself, we ascertained, as appears in the last Number of the 'Annals,' that the teeth of these animals are composed of silex. Directed by this interesting fact, I was induced to examine the nature of the instrument by which the carnivorous Gasteropods pierce the testaceous covering of bivalve and other shells. I found this apparatus in *Buccinum undatum* to be composed of rows of stout, much-curved spines or teeth, of great brilliancy, and as glossy and transparent as glass, and certainly to have no appearance whatever of horny tissue. They are so similar to those of *Eolis*, that there could be little doubt that they are formed of the same material; and accordingly, after subjecting them to the action of acid, such was found to be the case. Their capacity to drill holes in calcareous matter is therefore easily understood, without the necessity of supposing the aid of a solvent requisite, as surmised by Cuvier.

This result was to be expected after the discovery of the siliceous nature of the teeth of *Eolis;* but that the wood and stone-burrowing bivalves should work out their excavations by an instrument provided with the same material, may, perhaps appear somewhat startling. Such however I believe is the fact; a fact which if established will at once explain all the phenomena attending this much-controverted problem. It is not my intention at present to enter into details; all that I now wish to communicate is the result at which I have arrived; and in a short time I hope to have the pleasure of publishing, at length, my observations in connexion with this interesting subject.

The excavating instrument of *Pholas* and *Teredo* is formed of the anterior portion of the animal, in the surface of which are imbedded siliceous particles. The particles penetrating the skin give to it much the character of rasping-paper. The whole forms a rubbing surface, which being applied closely to the bottom of the cavity by the adhesion of the foot, enables the animal to rub down, and so penetrate shale, chalk, wood, or even the hardest limestones and marble.

Saxicava rugosa is also furnished with a rasping surface covered with siliceous particles. This surface, however, in this species is formed entirely of the anterior portion of the mantle, the margins of which being united are much thickened, forming a sort of cushion capable of considerable protrusion at the will of the animal. The foot is small, and passing through a much-constricted orifice, gives origin to a byssus, which anchors the shell close to the base of the excavation, and thus holds the rubbing apparatus in immediate contact with the part to be excavated.

58. *The Animal of the Spirula;* by J. E. GRAY, (Mag. Nat. Hist., xv, 1845, p. 257.)—Mr. GRAY states that the animal of the Spirula has hitherto been known only from a figure in the atlas of PERON and LESUEUR. He concludes from his examinations of a specimen in alcohol, (of which he gives figures,) that they resemble closely the cuttle-fish in external form, and will constitute a group of the Decapodous Cephalopods, forming a passage to the Octapodous; for like the latter, they are without a dorsal fin, and have a regularly chambered shell. The shell is enclosed with but a small part exposed, and is placed on the dorsal surface of the body with the spine bent towards the ventral sides.

"The examination of this animal confirms me in the opinion, which I expressed in the Synopsis of the British Museum, (1840, p. 149,) that the Ammonites, from their texture and the small size of the last chamber, are internal shells, and should be arranged with the Decapodous Cephalopods, being chiefly distinguished from the Spirulæ by the siphon, always on the dorsal margin of the whorls, and the septa being foliated on the edges."

59. *Adaptation of the Eye to Distinct Vision at Different Distances;* by Prof. FORBES, (Trans. Roy. Soc. Ed., xvi, 1.)—The crystalline lens,—for example, that of the ox,—is composed of a nearly spherical nucleus of compact, comparatively dense matter, of a hard pasty consistence; this nucleus gradually, yet rapidly passes into the gelatinous envelope, of a lenticular form, which has far less consistence and less resistance to external pressure, than the central spherule. Prof. FORBES thence suggests that any uniform pressure applied to the lens, such as might be communicated by the external muscles of the eye to the entire eye-ball, and propagated by hydrostatic pressure through the humors, would tend to make the exceedingly flattened ellipsoid of the eye approach in figure to the dense spheroidal nucleus; the obvious effect of this would be, to increase the curvature of the lens without changing its position, and thus render the rays from a near object more convergent. The effect probably proceeds from a simultaneous effort of the four *recti* muscles drawing the eye back in its socket.

IV. Botany.

60. *Number of Known Plants as given by Different Authors since Theophrastus, together with the supposed Total;* by R. B. Hind, (in Geographic Botany, Ann. Mag. Nat. Hist., xv, Jan. 1845, p. 12.)

		Known.	Supposed Total.
A. C. 300,	Theophrastus, History of Plants,	500	
A. D. 70,	Pliny, History of the World,	1,000	
1580,	Dodonæus, Stirpium Historia,	1,330	
1623,	Banhin, Pinax,	6,000	
1690,	Ray,		18,000
	Tournefort,	6,000	
1753,	Linnæus, Species Plantarum, 1st ed.,	7,300	
1762,	2d ed.,	8,800	
1796,	Gmelin, Systema Vegetabilium,	16,635	
1806,	Persoon, Enchiridium,	27,000	
	Humboldt,		44,000
1814,	Brown, Flinders' Voyage,	37,000	
1820,	De Candolle, Théorie Elémentaire,	50,000	100,000
1824,	Prodromus,	50,000	
1827,	Sprengel,	37,000	
1830,	Balbi, Geographie,		80,000
1835,	Lindley, Introduction to Botany,		86,000
1845,	R. B. Hind, (supposing, for reasons which he states, that one third yet remains to be discovered,		134,000

Mr. Hind gives the following as their probable distribution:

		Square Miles.
Europe,	11,200	2,793,000
Asia,	36,000	12,118,000
Africa,	25,200	8,500,000
North America,	14,400	11,146,000
South America,	40,000	
Australasia,	7,200	3,100,000
	134,000	37,657,000

61. *Potato disease*, (L'Institut, xiii, ann. 1845, pp. 325, 328, 343.) —The origin of this disease is traced by M. Payen, as has been done by others, to a cryptogamic vegetation propagating within the tubes. The fungus, whose spirules have followed the liquids infiltrated about the cortical parts especially, and sometimes the axis, develops in the cellules minute anastomosing filaments, which are nourished by the oily ingredients and enclosed fecula. Passing from one cellule to another, they bind the whole together so that the texture is not destroyed at the boiling point. The fibres growing outward towards the exterior sur-

face, attack all the azotized, oily and amylaceous substances which they can assimilate; the fecula or starch is gradually disaggregated, dissolved and absorbed, presenting a novel series of changes in the history of this substance. A humid state of the weather is believed to hasten the development of the potato fungus.

M. POUCHET points out four stages in the process of changes. In the *first* period, the tissues of the potato are hardly discolored; small clear brownish granules are distinguished at the surface of the membrane constituting the cellular tissue, especially in the intercellular spaces; the fecula of the cellules is untouched. In the *second*, the tissues are brownish; the brown granules upon the surface of the cellules have multiplied, and become deeper colored; the fecula is still in a healthy state. In the *third*, the granules have become of a deeper brown color, and the cellules gradually become broken into shreds, the starch or fecula being not yet at all altered. In the *fourth*, the tissues are soft and grayish; the cellular membranes are reduced to brown granulations resulting from the walls of the cellules and the granules on their surface. The starch grains remain "*dans leur integrité*." M. POUCHET does not believe that this disease results from the growth of a fungus (*Botrytis infestans*,) which M. MOREN has detected upon the leaves of the potato, and regards as its origin. The affection is considered analogous to that which destroys cellulous fruits, such as apples, pears, &c.; and a direct microscopic comparison is stated to favor the view.

The prevailing opinion and most observations are opposed to the views of M. POUCHET. M. PAYEN has compared by analyses the healthy and diseased potato, and found that the fecula has actually been diminished 20 per cent.

V. GENERAL PHYSICS.

62. *Temperature of the Mediterranean;* (extracted from a Memoir on the Temp. of the Medit., by M. AIME, Ann. de Chim. et de Phys., 3d ser., xv, 1845, p. 6.)—M. AIME arrives at the following conclusions from numerous observations on the temperature of the Mediterranean.

1. Near the coast the temperature during the day is higher than in the open sea, and at night lower.

2. The mean surface temperature for the year is nearly that of the air; in spring and summer it is less than that of the air, and in autumn and winter, greater. The surface temperature is never below 50° Fah.; and sometimes reaches to 79°.

3. The diurnal variation ceases to be appreciable at 20 yards, and the annual variation at 350 to 430 yards.

4. On a morning after a clear and calm night, the temperature of the surface is colder than that of the water several yards below.

5. The minimum temperature of the depths of the Mediterranean is equal to the mean temperature of the winter.

In the southern part the temperature decreases through the year, to a depth of 35 to 440 yards. In the northern part it increases during the winter to that depth. It seems consequently that the cold temperature below depends on the descent of the upper cold strata during winter, and not on the entrance of the waters of the ocean.

63. *Boiling point of Water at different heights;* by M. V. REGNAULT, (extracted from Ann. de Chim. et de Phys., XIV, 1845, 196.)—The following table has been made out by M. V. REGNAULT to aid in determining heights by the boiling point of water, a method recommended alike by its simplicity and the portable character of the instrument, and now very commonly adopted in preference to the barometer. The calculated results are shown to vary less than half a line in the height of the barometric column from those by observations.

M. REGNAULT states that the thermometer should be made of the best crystal glass, as others dilate irregularly. They are graduated from 75° to 100° C., (equivalent to 167° to 212° Fah.,) and the following is the method adopted for this purpose. As much mercury is introduced in the usual way as will stand one third up the stem when placed in melting ice; this point (designated n) is accurately marked. The tube is then placed alongside of another graduated thermometer in a large vessel full of water, kept agitated, and exactly at 20° C. (68° Fah.); and the height of the mercury (n') corresponding to the degree of temperature (t) indicated on the graduated scale is noted. $\frac{n'-n}{t}$ will then give the value of a degree. A portion of the mercury is next expelled, so that it will reach towards the top of the tube when in boiling water, and the tube is closed as usual. It is then placed in the vapor of boiling water under a pressure of about 760 millimetres, and the point at which the mercury stands (n'') is noted, and also the exact temperature (T). The value of a corrected degree may then be obtained by the following formula:—

$$\frac{\frac{n'-n}{t}+\frac{1}{6480}(n''-n)}{1+\frac{T}{6480}}$$

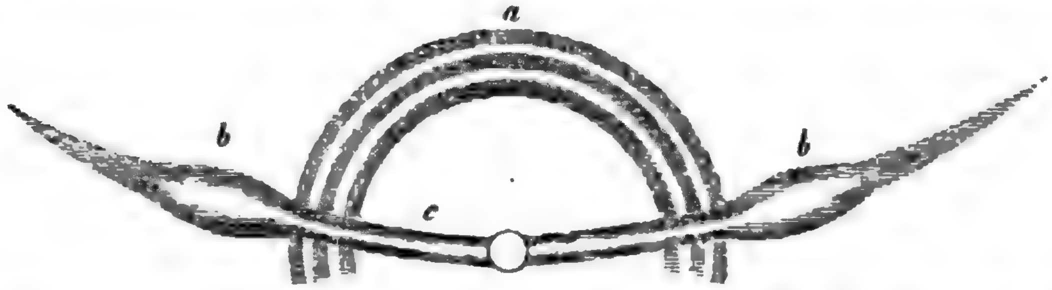
The instrument is made of brass tubes that slide into one another like a spy-glass, and is but six inches long when closed up, but may be drawn out to a length of fifteen inches. The lower part, which contains the water to be heated, is one and one-eighth inches in diameter. This is inserted in a large cylindrical vessel, which has a lamp at bottom. The thermometer is dropped down into the vapor just above the surface of the boiling water.

The table gives for each tenth of a degree Centigrade, between 85° and 101°, the amount of barometric pressure reduced to 0°, corresponding to the temperatures observed, of boiling water. The calculations are in French measures. A millimetre = .03937 English inches. The Centigrade scale is used in the table.

Table of the tension of the vapor of water in millimetres, from 85 *to* 101 *degrees* C.

Degree.	Tension.	Diff.	Degree.	Tension.	Diff.	Degree.	Tension.	Diff.	Degree.	Tension.	Diff.
°	*mm*		°	*mm*		°	*mm*		°	*mm*	
85·0	433·04	1.71	89·0	505·76	1·94	93·0	588.41	2·20	97·0	682·03	2·49
85·1	434·75	1·71	89·1	507·70	1·95	93·1	590·61	2·21	97·1	684·52	2·50
85·2	436·46	1·71	89·2	509·65	1·95	93·2	592·82	2·22	97·2	687·02	2·51
85·3	438·17	1·72	89·3	511·60	1·96	93·3	595·04	2·22	97·3	689·53	2·51
85·4	439·89	1·73	89·4	513·56	1·97	93·4	597·26	2·23	97·4	692·04	2·52
85·5	441·62	1·73	89·5	515·53	1·97	93·5	599·49	2·23	97·5	694·56	2·52
85·6	443·35	1·74	89·6	517·50	1·98	93·6	601·72	2·25	97·6	697·08	2·53
85·7	445·09	1·75	89·7	519·48	1·98	93·7	603·97	2·25	97·7	699·61	2·54
85·8	446·84	1·75	89·8	521·46	1·99	93·8	606·22	2·26	97·8	702·15	2.55
85·9	448·59	1·75	89·9	523·45	2·00	93·9	608·48	2·26	97·9	704·70	2·56
86·0	450·34	1·76	90·0	525·45	2·00	94·0	610·74	2·27	98·0	707·26	2.56
86·1	452·10	1·77	90·1	527·45	2·01	94·1	613·01	2·28	98·1	709·82	2·57
86·2	453·87	1·77	90·2	529·46	2·02	94·2	615·29	2·29	98·2	712·39	2·58
86·3	455·64	1·78	90·3	531·48	2.02	94·3	617·58	2·29	98·3	714·97	2·59
86·4	457·42	1·79	90·4	533·50	2·03	94·4	619·87	2·30	98·4	717·56	2·59
86·5	459·21	1·79	90·5	535·53	2·04	94·5	622·17	2·31	98·5	720·15	2·60
86·6	461·00	1·80	90·6	537·57	2·04	94·6	624·48	2·31	98·6	722·75	2·60
86·7	462·80	1·80	90·7	539·61	2·05	94·7	626·79	2·32	98·7	725·35	2·61
86·8	464·60	1·81	90·8	541·66	2·06	94·8	629·11	2·33	98·8	727·96	2·62
86·9	466·41	1·81	90·9	543·72	2·06	94·9	631·44	2·34	98·9	730·58	2·63
87·0	468·22	1·82	91·0	545·78	2·07	95·0	633·78	2·34	99·0	733·21	2·64
87·1	470·04	1·83	91·1	547·85	2·07	95·1	636·12	2·35	99·1	735·85	2·65
87·2	471·87	1·83	91·2	549·92	2·08	95·2	638·47	2·36	99·2	738·50	2·66
87·3	473·70	1·84	91·3	552·00	2·09	95·3	640·83	2·36	99·3	741·16	2·67
87·4	475·54	1·84	91·4	554·09	2·10	95·4	643·19	2·38	99·4	743·83	2·67
87·5	477·38	1·85	91·5	556·19	2·10	95·5	645·57	2·38	99·5	746·50	2·68
87·6	479·23	1·85	91·6	558·29	2·10	95·6	647·95	2·39	99·6	749·18	2·69
87·7	481·08	1·86	91·7	560.39	2·12	95·7	650·34	2·39	99.7	751·87	2·70
87·8	482·94	1·87	91·8	562·51	2·12	95·8	652·73	2·40	99·8	754·57	2·71
87·9	484·81	1·88	91·9	564·63	2·13	95·9	655·13	2·41	99·9	757·28	2·72
88·0	486·69	1·88	92·0	566.76	2·13	96·0	657·54	2·41	100·0	760·00	2·73
88·1	488·57	1·88	92·1	568·89	2·14	96·1	659·95	2·42	100·1	762·73	2·73
88·2	490·45	1·89	92·2	571·03	2·15	96·2	662·37	2·43	100·2	765·46	2·74
88·3	492·34	1·90	92·3	573·18	2·16	96·3	664·80	2·44	100·3	768·20	2·75
88·4	494·24	1·91	92·4	575·34	2·16	96·4	667·24	2·45	100·4	771·95	2·76
88·5	496·15	1·91	92·5	577·50	2·17	96·5	669·69	2·46	100.5	773·71	2·77
88·6	498·06	1·92	92·6	579·67	2·17	96·6	672·14	2·46	100·6	776·48	2·78
88·7	499·98	1·92	92·7	581·84	2·18	96·7	674·60	2·47	100·7	779·26	2·78
88·8	501·90	1·92	92·8	584·02	2·19	96·8	677·07	2·48	100·8	782·04	2·79
88·9	503·82	1·94	92·9	586·21	2·20	96·9	679·55	2·48	100·9	784·83	2·80
89·0	505·76		93·0	588·41		97·0	682·03		101·0	787·63	

64. *Remarkable Paraselene witnessed on the night of the* 19*th April*, 1845; by Prof. CHAS. G. PAGE, M. D., (in a letter to Prof. SILLIMAN.) —Parhelia of varied forms are often seen in this region, and more particularly late in the autumn; but it has never been my good fortune to witness a distinct paraselene, until the above period. Being merely a casual observer of the heavens, I bear record of such phenomena with diffidence, and hoped to have seen ere this time, some faithful notices of this rare appearance by those who explore the heavens with more than the unassisted eye. The above sketch agrees in several particulars with one given by Mr. R. W. BIRT in the Philosophical Magazine, No. 121, of a paraselene witnessed by him on the 6th May, 1841. The halos and luminous portions were formed upon a light cloud of the class cirro-stratus, first making their appearance about half past 9 P. M., and lasting one hour. The moon was nearly full, and high in the heavens. There were three distinct concentric halos, of the general prismatic character of the large halo or circle so often seen around the moon, the outermost of which presented a diameter of about one half that of the large halos. The halos during the whole time extended only a very little beyond a semicircle. At their uppermost point (*a*) there appeared a diffused luminosity, too faint to define by representation, but at the points *b*, *b*, (and what seemed to be extraordinary)—*without* the circle of the halos, there were two brilliant oval spots, not appearing as defined images of the moon, but bearing about the same relation to the moon in intensity of light, as parhelia do to the sun. From these, there extended for some distance a nebulous pencil, as seen in the figure. A belt of light curved somewhat as represented in the figure, extending from the moon on either side, seemed to form the base of the arch made by the halos, but on close observation it was found that the halos appeared faintly for a short distance below the belt. In the paraselene described by Mr. BIRT, the images of the moon were directly upon or coincident with the halos, but were represented as of a lozenge shape. The circle of halos in the same case was also incomplete, and the belt of light subtending the semicircle of halos, was similar to that I have represented.



Washington, D. C., Sept. 18, 1845.

65. *Recent Progress of Magnetical and Meteorological Science,—being notices of several new publications both American and Foreign on these subjects.*

(1.) *Observations made at the Magnetical and Meteorological Observatory at Toronto in Canada,* 1840, 1841, *and* 1842. 4to.

We are beginning to reap the fruits of the grand system of magnetical and meteorological observations which was commenced in 1840. Several volumes of observations have already appeared, and we shall look for others in due time. Above we have given the title of a thick quarto volume, containing at large the observations of three years at Toronto. It is a splendid volume, and will prove a lasting monument of the liberality of the British government.

The Toronto Observatory is situated in latitude 43° 39′ 35″ N., longitude 79° 21′ 30″ W., and is 108 feet above the surface of Lake Ontario. The main observatory has two apartments—one 50 feet by 20 for the instruments, the other 18 feet 12 for a computing room. The observatory was provided with instruments for measuring the declination and inclination of the magnetic needle, the horizontal and vertical force, and also with a complete set of meteorological instruments. We regret that we can only find room for a few of the results of these observations.

The mean declination of the needle for 1841, was 1° 14′·35 west.
" " " 1842, " 1° 18′·95
Annual increase of west declination, 4′·6.
The mean inclination of the needle for 1841, was 75° 17′·0
" " " 1842, " 75° 16′·4

The results for the two years are so nearly identical, as to prove that the annual change of inclination must be exceedingly small, and even to leave it uncertain in what direction this change is taking place.

The magnetic observations on the term days are all projected in curves; and side by side are placed for comparison the curves at Boston and Philadelphia. The correspondence in the motions of the needle at these three places was generally quite remarkable; all the larger movements at either station, and frequently also the most minute ones, being exactly copied at each of the other stations.

The mean temperature of 1841, was . .		43°·9
" " 1842, " . .		44°·8
The greatest heat of the two years, was	91°·7	
The greatest cold " " "	—5°·2	
Range of the thermometer, . . .	96°·9	
The maximum of the barometer, was . .		30·417
The minimum " " "		28·672
Range in two years, ...		1·745

The least degree of humidity was 22, the point of saturation being represented by 100.

The following is the mean result of the barometric observations for two years.

	6 A. M.	8.	10.	noon.	2 P. M.	4.	6.	8.	10.	midnight	2 A. M.	4.
Gaseous atmosphere,	29·379	·375	·364	·333	·310	·311	·326	·348	·357	·361	·364	·370
Aque'us vapor,	·241	·259	·271	·281	·285	·279	·269	·256	·250	·243	·238	·234
Total pressure,	29·620	·634	·635	·614	·595	·590	·595	·604	·607	·604	·602	·604

The diurnal pressure of the gaseous atmosphere has one maximum which occurs about the coldest hour of the day, and one minimum which occurs about the warmest hour of the day. The elastic force of the vapor has also one maximum which occurs at 2 P. M. and one minimum at 4 A. M. The sum of these two pressures however exhibits two daily maxima, viz. at 10 A. M. and P. M.; and two daily minima, viz. about 3 or 4 A. M. and P. M. Thus this knotty question respecting the diurnal oscillations of the barometer has been beautifully resolved by simply *interrogating nature.*

The pressure of the wind resolved in the direction of the four cardinal points, was as follows:

Date.	N.	E.	S.	W.
1841,	1832·6 lbs.	957·2	747·4	1741·4
1842,	2544·4	1386·2	1293·3	2697·4

The mean direction of the wind is accordingly N. 41° 53′ W. The greatest pressure observed during the two years was 15 pounds per square foot, Feb. 3, 1841.

The amount of rain in 1841, was . . 36·58 inches.
" " " 1842, " . . 42·80 "

(2.) *Observations in Magnetism and Meteorology, made at Makerstoun, Scotland, in the Observatory of Sir* T. M. BRISBANE, 1841 *and* 1842.

These are the fruits of a private observatory established by General BRISBANE in concert with those which were endowed by the governments of Europe. The observatory is situated in latitude 55° 34′ 45″ N., longitude 0^h 10^m 3^s·5 W.

According to these observations, the mean declination in 1842 was 25° 28′·56 W. Yearly decrease of west declination, 4′·07.

Greatest declination observed, . .	27° 1′·56
Least " " . .	24° 54′·28
Range in 17 months, ...	2° 7′·28

Mean magnetic dip for 1842, 71° 11′·95. Yearly decrease of dip, 4′·83.

Greatest height of the barometer, . .	30·304
Least " " " . .	28·262
Range in 17 months, ...	2·042

The amount of cloudiness appears to be very high; but as the observations only embrace a period of eight months, perhaps they are not a fair representation of the climate.

The average amount of rain in a period of 11 years, was 24·565 inches, as determined by a gauge placed six feet above the soil.

(3.) *Annuaire Magnetique et Meteorologique de Russie, par* A. T. Kupffer, 1842. 4to. [The 7th of the Series.]

In this imperial Annuaire, worthy of the Cesars, we find meteorological observations made *every hour of the day*, at St. Petersburg, Barnaoul, Nertchinsk, Catherinenburg, and Sitka; and observations made *eight hours* of the day at Zlatouste, Bogoslowsk, Lougan, and Peking; observations which are more valuable, as several of these places are situated in a quarter of the globe hitherto but little known. Most of these stations have also furnished magnetic observations. The following is a summary of some of the results for 1842.

Places.	Latitude.	Longitude.	Dip.	Declination.	Annual variation.
St. Petersburg,	59° 56′ N.	30° 19′ E.	71° 0′·3	6° 21′·1 W.	—4′·9
Catherinenburg,	56 51	60 34	69 53′·5	6 38′·9 E.	
Barnaoul,	53 20	83 56	70 7′·2	8 24′·8 E.	
Nertchinsk,	51 56	116 31	67 7′·9	3 46′·9 W.	
Peking,	39 54	116 26	55 42′·0		
Kazan,	55 48	49 7	68 23′·0		

The following is a summary of the observations on the pressure of the air.

St. Petersburg.	Noon.	1 P.M.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Dry air, . .	29·870	·867	·864	·863	·865	·866	·870	·872	·873	·874	·875	·875
Vapor, . .	·117	·117	·118	·118	·116	·115	·113	·113	·111	·110	·109	·108
Total, . .	29·987	·984	·982	·981	·981	·981	·983	·985	·984	·984	·984	·983
Barnaoul.												
Dry air, . .	29.432	·433	·434	·437	·439	·438	·438	·438	·438	·436	·437	·439
Vapor, . .	·106	·105	·104	·101	·099	·097	·095	·093	·091	·090	·089	·087
Total, . .	29·538	·538	·538	·538	·538	·535	·533	·531	·529	·526	·526	·526
Catherinenburg.												
Dry air, . .	28·883	·884	·886	890	892	·895	·898	·900	·900	·900	·898	·898
Vapor, . .	·090	·090	·090	·089	089	·089	·089	·088	·087	·086	·086	·085
Total, . .	28·973	·974	·976	·979	·981	·984	·987	·988	·987	·986	·984	·983
Sitka.												
Dry air, . .	29 804	·801	·802	·802	·801	·802	·804	·809	812	813	·815	·814
Vapor, . .	·132	·131	·129	·128	·126	125	·123	121	·120	120	119	118
Total, . .	29·936	·932	·931	·930	·927	927	·927	·930	·932	·933	934	·932

St. Petersburg.	Midn't.	1 A. M.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Dry air,	29·874	·873	·871	·869	·868	·866	·866	·867	·870	·871	·869	·868
Vapor,	·107	·106	·105	·105	·106	·107	·109	·112	112	·114	116	·116
Total,	·981	·979	·976	·974	·974	·973	·975	·979	·982	·985	·985	·984
Barnaoul.												
Dry air,	29·438	·438	·438	·436	·435	·435	·432	·428	·425	·421	·416	·416
Vapor,	·089	·091	·095	·100	·104	·106	·109	·111	·112	·113	·114	·112
Total,	29·527	·529	·533	·536	·539	·541	·541	·539	537	·534	·530	·528
Catherinenburg.												
Dry air,	28·898	·897	·896	893	·892	·892	890	·889	·887	·884	·882	880
Vapor,	·084	·084	084	·087	·089	·090	·091	·091	·092	·092	092	092
Total,	28 982	·981	·980	·980	·981	·982	·981	·980	·979	·976	·974	·972
Sitka.												
Dry air,	29 810	·808	·806	·804	·802	·803	805	·807	807	·807	·807	·806
Vapor,	·117	·117	·117	·119	·121	·125	·127	·129	·131	·133	·133	·133
Total,	29·927	·925	·923	·923	·923	·928	932	·936	·938	·940	·940	·939

According to all of these observations, the elastic force of the vapor of the air has one daily maximum and one daily minimum.

According to the	St. Petersburg	obs. the max. occurs	2½ P. M.,	the min.	2½ A. M.
" "	Barnaoul,	" " "	10 A. M.,	"	11 P. M.
" "	Catherinenburg,	" " "	9½ "	"	1 A. M.
" "	Sitka,	" " "	10 "	"	1 "

At St. Petersburg,	the greatest heat occurs at	2 P. M.,	greatest cold at	3 A. M.
At Barnaoul,	" " "	9½ A. M.,	" "	11 P. M.
At Catherinenburg,	" " "	10 "	" "	1 A. M.
At Sitka,	" " "	10½ "	" "	1 "

The minimum pressure of the vapor occurs at almost the precise instant of minimum temperature, and so also with the maxima.

The pressure of the gaseous atmosphere has one daily maximum at Catherinenburg about 8 P. M. and one daily minimum at 10 A. M., and the motion is throughout extremely regular. At the other three stations there is a maximum about the time of greatest cold, and a minimum about the time of greatest heat; but there are also subordinate maxima and minima. Possibly the direction of the wind may have some influence in producing these irregularities.

The following is the amount of rain and snow during the year.

St. Petersburg,	18·5 inches.	Zlatouste,	14·67 inches.
Barnaoul,	19·13 "	Bogoslowsk,	15·98 "
Nertchinsk,	13·81 "	Lougan,	15·47 "
Catherinenburg,	11·78 "	Peking,	27·98 "

(4.) *Observations Meteorologiques faites à Arkangel.* Lat. 64° 32′, long. 40° 34′ E.; *et communiquées par* M. Kupffer.

This volume contains observations of eighteen and a half years, from June, 1813, to December, 1831; and they are of very great importance as coming from so high a latitude.

The greatest height of the barometer for the entire period was 30·97 inches. Least height, 27·97 inches. Range in 18½ years, 3·00 inches.

The mean temperature of the entire period, was +0°·68 Reaumur, =33°·53 Fahrenheit.

	Reaumur.	Fahrenheit.	
The highest temp. was	32°·5 =	105°·12,	July 2, 1818.
The lowest " "	–35°·0 =	–46°·75,	Jan. 1, 1814. Jan. 18, 1828.
Range of 18 years,	67°·5 =	151°·87	

In two instances the thermometer is said to have sunk to —35°·0, once to —33°·8, twice to —31°·5, and twice to —31°·0. The observations were all made with a mercurial thermometer, and mercury freezes at —31° Reaumur; that is, according to these observations the temperature fell repeatedly below the point of congelation of mercury.

The following table shows the influence of wind upon temperature.

With a	north wind, the mean temp. was	–1°·1	Reaum.
"	northwest wind, " " "	+1°·0	"
"	west " " " "	+1°·8	"
"	southwest " " " "	+2°·8	"
"	south " " " "	+2°·6	"
"	southeast " " " "	+0°·8	"
"	east " " " "	–1°·4	"
"	northeast " " " "	–2°·2	"

The coldest wind is from the northeast, and the warmest from the southwest.

The following table shows the number of times the wind was observed to blow from each of the cardinal points.

North, . . .	2350	Southeast, . .	2760
Northwest, . .	2023	East, ...	2239
West, . . .	3007	Northeast, . .	1426
Southwest, . .	2757	Calm, . . .	1784
South, . . .	1969		

The mean direction deduced from these numbers, is S. 47° 42′ W.; but the mean progress in that direction is *less than one twelfth* of the entire velocity of the wind—so that at Arkangel the wind has *no prevalent direction.* The atmosphere oscillates to and fro, and the inhabitants inhale the same particles of air from generation to generation.

(5.) *Ueber das Magnetische Observatorium der Sternwarte bei München.—Bestimmung der Horisontal Intensitat der Erdmagnetismus.—Resultate der Magnetischen Beobachtungen in München*, 1840, 1841, 1842; von Dr. J. Lamont.

The first of the above named pamphlets contains a particular description of the Magnetic Observatory at Munich; the second contains a treatise on the absolute determination of the horizontal intensity of the earth's magnetism; and the third contains the results of three years magnetic observations.

The mean declination of the magnetic needle at Munich—

For 1841, was	16° 54′·4
1842, "	16° 48′·0
Annual decrease of west declination, .	6′·4

(6.) *Proceedings connected with the Magnetical and Meteorological Conference held at Cambridge, (Eng.) in June,* 1845.

From this pamphlet we learn that the British government have resolved to equip a new Arctic expedition under the command of Sir John Franklin, with a view to the completion of the discovery of a northwest passage. The expedition, consisting of the *Erebus* and the *Terror*, furnished with steam-power, and provided with all the instruments necessary for the prosecution of magnetic and meteorological observations, sailed during the summer of 1845.

A new magnetic observatory has recently been established in British Guiana; and an observatory is in contemplation at Colombo, in Ceylon.

Lieut. Lefroy has completed his magnetic survey of an important part of North America. He has determined the three magnetic elements at above 100 stations within the isodynamic oval of 1·7.

Lieuts. Moore and Clerk sailed in the *Pagoda*, Jan. 9th, 1845, from Simon's Bay, on the magnetic survey of that part of the Atlantic Ocean left unexplored by Sir James Ross. She crossed the Antarctic circle on the 5th of February, in long. 30° 45′ E., and her furthermost point south was 67° 50′. She returned to the Cape, via St. George's Sound, Australia, on the 20th of June last, having sailed over more degrees of longitude within the sixtieth parallel than any other single vessel. As the second term of three years, during which the magnetic and meteorological establishments of the British and other governments were to be continued, would expire with the year 1845, the magnetic committee of the British Association, about a year since, entered into an extensive correspondence with foreign meteorologists on the subject of a continuance of the observations. Several distinct questions were proposed, upon which opinions were requested. Replies were received from a large number of individuals, generally expressing the desire that the observations might be continued, with some modifications. The most eminent persons in these sciences from all parts of the world, were invited to a conference on the subject, which was held at Cambridge in June last. Among others, there were present at the conference, Messrs. Kupffer, Kreil, Erman, Dove, Boguslawski and Leuftenberg. The result of this conference was the adoption of resolutions recommending the continuance of observations upon substantially the present system, for another period of three years. It is to be hoped that this recommendation will be generally concurred in, and that the coöperation during the coming three years will be more general and enthusiastic than ever.

(7.) *First Report on Meteorology;* by JAMES P. ESPY.

This report consists chiefly of maps of the United States, exhibiting the direction of the wind, state of the barometer, thermometer, &c., on various days in January, February and March, 1843. There are twenty nine of these maps, which contain a vast amount of valuable information. They clearly indicate the proper course to be pursued if we would arrive at a complete knowledge of the laws of storms. Several important generalizations deduced from these observations, accompany the report. The following are some of them.

Storms in the United States travel from west to east; they are accompanied with a depression of the barometer near the centre of the storm; they travel about 36 miles per hour; in great storms, the wind for several hundred miles on both sides of the line of minimum pressure, blows towards that line, directly or obliquely. The force of the wind is in proportion to the suddenness and greatness of the barometric depression. In all great and sudden depressions of the barometer, there is much rain or snow; and in all sudden and great rains or snows, there is a great fluctuation of the barometer.[*] Many storms are of great and unknown length from north to south, while their east and west diameter is comparatively small. There is generally a lull of wind at the line of minimum pressure, and sometimes a calm. When the wind changes to the west, the barometer generally begins to rise. There is generally but little wind near the line of maximum pressure, and on each side of that line the winds are irregular, but tend outwards from that line. The fluctuations of the barometer are generally greater in the northern than in the southern parts of the United States, and greater in the eastern than in the western parts.[†]

(8.) *Magnetical and Meteorological Observations made at Washington;* by Lieut. J. M. GILLISS. 8vo., pp. 648.

The instruments used in these observations were a declinometer and dip circle by SIMMS, a barometer, several thermometers, hygrometer, rain gauge, &c. The magnetic observations embrace two years, from July, 1840, to June, 1842.

The mean declination for 1840–1, was 1° 20′ 12″·7 W.
" " 1841–2, " 1° 23′ 56″·9
Annual variation, . . . 3′ 44″·2

The minimum declination for each day occurs at 8h. 6m. A. M.
Maximum " " " 1 33 P. M.
A secondary minimum occurs . . . 9 46 "
" maximum " . . . 2 10 A. M.

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[*] There are some remarkable cases of great rains with little motion of the barometer.

[†] We should like to see the evidence of the second part of this statement.

The mean diurnal variation for summer, is .	10′ 4″·1
" " autumn, . .	6′ 21″·9
" " winter, . .	4′ 36″·3
" " spring, . .	8′ 10″·7
The mean dip for 1840–1, was . . .	71° 20′·2
" 1841–2, ...	71° 18′·0

The meteorological journal embraces four years, from July, 1838, to June, 1842.

The maximum of the barometer for two years, was	30·810
Minimum " "	29·074
Range, ...	1·736
The maximum temperature was	103°·0
Minimum "	—4°·5
Range for four years, ...	107°·5

Mean temperature of Washington from four years, 53°·97.

The following is the result of four years observations of the winds:

No. of observations from the South, . .	32·7
" " Southwest, .	56·2
" " West, . .	38·4
" " Northwest, .	70·3
" " North, . .	26·3
" " Northeast, .	43.2
" " East, . .	18·9
" " Southeast, .	20·3
" " Calm, . .	52·8

Mean direction of the wind, N. 71° 51′ W.

Mean annual amount of rain, 41·21 inches.

The subject of meteorology is every year attracting increased attention both in this country and in Europe, and the perseverance of its cultivators has been rewarded with considerable success. We have advanced so far that we can see very clearly what is wanted to ensure further progress. A vast number of meteorological journals are kept in the United States, and a great amount of industry expended upon them. We need however more uniformity of system—in many cases better instruments, and in some quarters a great increase of observers. In order to be able to investigate satisfactorily the phenomena of a great storm, we need observations throughout its entire extent, from stations not more than fifty miles from each other,—observations with good instruments and upon a uniform plan. Is this idea too gigantic to be realized? Let us see what materials we have to depend upon.

I. The general government has manifested a very commendable zeal on this subject. Observations of the thermometer have long been made at some of the military posts, but recently their number has been much increased, and the observations made much more valuable by the addition of barometers, &c. This system might very profitably be extended still further, so as to include forts, light-houses, navy yards, arsenals, &c.; and those stations are the more important, as many of them are upon the very outskirts of civilization, where it would be difficult to obtain observations from any other source.

II. Two of the state governments, viz. New York and Pennsylvania, have set a most praiseworthy example in their encouragement of meteorological observations. For twenty years the state of New York has required a register to be kept at each of the academies subject to the Board of Regents. These observations have furnished results of the greatest value. Nevertheless it is time that the system in that state was revised. The observations are incomplete without a barometer, and it is desirable that the stations be distributed more uniformly over the state. We sincerely hope that other states will emulate the noble examples of New York and Pennsylvania. Many of them might do it without the least inconvenience, and the results of the observations would be interesting to every member of the community.

III. Our main reliance in every scientific enterprise must be on private zeal. This zeal in some parts of the country is still to be awakened, and where zeal is already awakened, it needs to be directed. We want more observers from the north of New England, and every where throughout the South and West. Here is a great work which naturally devolves upon the philosophical societies. Let every philosophical society in the United States, within the sphere of its influence, strive to organize a company of observers occupying the whole country at intervals of fifty miles; and after deciding upon the best plan of observations, endeavor to persuade every observer to adopt the same system.

IV. The British government have established a noble observatory at Toronto. Subordinate stations might be established at every military post in Canada, at a trifling expense, which would powerfully contribute to the promotion of meteorology. It is important to determine the *limits* of our great storms, but they very frequently extend northward to an unknown distance beyond the limits of the United States. Hence we need the coöperation of the British government, and we flatter ourselves that when the importance of the subject is fully presented to their consideration, they will respond to the call with that discriminating liberality which has ever characterized their patronage of science.

[Our magnetical and meteorological summary having extended to an unexpected length, has excluded some *astronomical* and other scientific notices which were intended for this number. They shall however appear in our next.—*Eds.*]

MISCELLANEOUS ITEMS.

66. At the Italian Scientific Association for 1844, VON BUCH exhibited a geological map of Sicily made by M. HOFFMANN, and observing that the granites of Calabria have a relation to those of Sicily, deduced that the Straits of Messina must have been produced at the period of the granitic eruptions; and consequently that Sicily and Calabria were never united.—*L'Institut, No.* 603, 1845, *p.* 260.

67. The *Geological Society of France* commenced their extraordinary session for the past year on the 14th of September at Avallon. The place was selected on account of the great geological interest of the country around.

68. *Expedition to Siberia*, (L'Institut, No. 603, 1845, p. 257.)—M. MIDDENDORFF is engaged on an expedition into Siberia, and has already made extensive observations and collections towards elucidating the natural history of that country.

69. *Rail Road Excavations in England.*—The sections made through the country are not only bringing to light interesting geological facts, but curious historical monuments. The line of railway from Brighton to Lewes cuts directly through the ancient Priory destroyed by Henry VIII, and across the site of the high altar and the leaden coffins of *William of Warren and his countess Gundreda*, daughter of William the Conqueror, and the skeletons when disinterred were found in very tolerable preservation. They are to be placed in Southover church under the sepulchral tablet of Gundred, which had been thrown by when the Priory was destroyed, and was made use of (the smooth side upward) in the tomb of a country gentleman, EDWARD SHIRLEY, in a village church-yard seven miles from Lewes; now the bones will be again covered by the Latin laudatory hexameters.*

70. Professor BALFOUR, late of the University of Glasgow, has been elected to the botanical chair in the University of Edinburgh, vacated by the death of the excellent Dr. GRAHAM. We learn that the professorship at Glasgow, relinquished by Dr. BALFOUR, has been offered to that very able botanist, G. A. WALKER ARNOTT, Esq. of Arlary, Kinrosshire.

71. *Identity of Light, Heat and Electricity*, (Athenæum, No. 941.)—Mr. FARADAY, on the 2d of Nov. last, announced, at a meeting of the Council of the Royal Institution, a very remarkable discovery; which appears to connect the imponderable agencies yet closer together, if it does not indeed prove that light, heat and electricity are merely

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* In the history of the antiquities of Lewes by HORSFIELD, we find a drawing of Gundreda's tomb; the slab referred to above was beautifully and deeply sculptured both for the inscription and the ornaments.—EDS.

modifications of one great universal principle. This discovery is, that a beam of polarized light is deflected by the electric current, so that it may be made to rotate between the poles of a magnet; and, as we understand, the converse of this, that electro-magnetic rotations may be produced by the agency of light. Thus the problem which has disturbed science for a long period as to the power of magnetizing iron by the sun's rays, as stated by Mrs. Somerville, Morrichini and others, receives satisfactory elucidation from the indefatigable industry of Mr. Faraday. Already has he proved the identity of machine, chemical, magnetic and animal electricity; and now, advancing a step higher in the inquiry, he finds the most ethereal principle with which we are acquainted capable of producing phenomena which have hitherto been regarded as the exclusive property of ponderable bodies only. Light, the subtile agent of vision, the source of all the beauty of color, is now shown to have some close relation with electricity, to which has long been referred many of the vital functions. As life and organization exist only where there is light, this discovery of Mr. Faraday's would appear to advance us towards some knowledge of those physiological phenomena which are the most recondite subjects of science.

72. *Note on Prof. Twining's Article.*—We have, on account of its ingenuity and plausibility, inserted (at p. 89) Prof. Twining's solution of the much vexed problem concerning parallel lines. We ought, however, to state that a scientific friend to whom we referred the paper, does not consider the course of reasoning satisfactory, and we have thought best to insert here the remarks which he has furnished.—*Eds.*

The reasoning in question is certainly of a novel and ingenious character, but is not free from steps that are objectionable. That there must be *some* fallacy in it, might be shown by pointing out cases where false conclusions would result from applying it with proper modifications, though without essential change. It will, however, be more satisfactory to learn, if possible, in what particulars the reasoning is faulty.

On page 95, the angle BAD is determined by the condition that it be such as to contain all the lines which can be drawn through A, to meet FG or FG produced beyond G. Then it is said that CAD cannot be so conditioned as simply to contain all the lines that will *not* meet FG produced as before; for in that case AD must meet and not meet FG at the same time. Now this conclusion appears inadmissible. It is founded plainly on the assumption that in determining the angle BAD to be such as to contain all of a certain class of lines, every other line is excluded from it; in other words, that the line AD, which is the limit of a certain class of lines, must itself be comprehended in that class. This surely would not be an authorized assumption, even if it were not erroneous.

There are many cases in which difficulty may be occasioned by inattention to the kind of consideration we here advert to. In the case before us, a clear distinction is observable between AD considered as a limit of the lines which meet FG produced, and AD considered as the limit of those lines which do *not* meet FG produced. In the former case, the line AD belongs not to the class of lines limited by it, while in the latter, it is one of that class of lines which it limits. At the bottom of page 95, this important distinction is disregarded, when it is said that if AD is contained by BAD, it must meet FG or FG produced.

Further objections to the demonstration under notice, similar to those here suggested, might be advanced; but if the consideration which has been referred to be kept in view, they will readily occur to the reader.

A. D. S.

BIBLIOGRAPHY.

1. *Notice of* Mr. ALGER'S PHILLIPS' *Mineralogy.*—Prof. GUSTAV LEONHARD of Heidelberg, Germany, has given a very favorable notice of Mr. ALGER's book, (already reviewed in this Journal.) It appears in the Annals of the University of Heidelberg, and we abstract from it the following:—

"The fifth edition of a work is the best encomium upon its character, especially of one of a scientific nature. The first four editions of PHILLIPS's work appeared in London; the fifth has now been published in Boston, edited by Mr. ALGER, whose name was previously advantageously known by his beautiful investigations in Nova Scotia, and by the Essay which he published thereupon in common with Dr. JACKSON. It was but very recently that we had occasion to allude in these pages to the scientific activity that reigns in the United States; and this work of Mr. ALGER furnishes us with additional proof thereof. The Mineralogy of PHILLIPS appears in a new dress, much improved and augmented. The minerals are arranged according to a chemical system. The most satisfactory and accurate analyses are given for each species, and there are additional analyses by Dr. JACKSON and others, of American minerals, as Danaite, Cavanite, Hudsonite, Masonite, and Ledererite. The figures of the crystals, amounting to 600, are admirable, and there is much interesting information touching the occurrence of minerals, those of Nova Scotia and South America in particular. There is no doubt in our mind that Mr. ALGER's Mineralogy, splendid as it is in its getting up, will find many readers. It is peculiarly adapted as a compendium for students."

2. *Die Meteoriten, or Meteorites in the Imperial Mineral Cabinet at Vienna;* by PAUL PARTSCH. pp. 162, 8vo, with a plate. Vienna, 1843.—The Vienna cabinet of meteorites contains two hundred and fifty

eight specimens; they are from ninety four distinct meteorites, twenty five of which are of meteoric iron. Their physical characters are quite fully described by M. Partsch, and much information is added with regard to their geographical history. A table exhibiting their commerical value appended to the work, increases much its interest.

The value of the Elbogen meteorite (iron) weighing 141 Vienna pounds* is stated at	10,000	florins.
The Agram meteorite, weighing 70 pounds, at .	10,000	"
An Atacama specimen, " 5 " $5\frac{1}{2}$ loth,	506	"
Weston (Connecticut) meteoric stone, weighing 3 loth,	15	"
Nashville (Tennessee) " " " $1\frac{27}{32}$ "	20	"
Richmond (Virginia) " " " $3\frac{7}{8}$ "	36	"

3. *Works of the Exploring Expedition.*—Two of the scientific volumes of the Exploring Expedition under Capt. Wilkes are just leaving the press, one by Horatio Hall on *Ethnography* and *Philology*, the other by James D. Dana on *Zoophytes*, including descriptions of species of corals. The latter is to be accompanied by an atlas of sixty one folio plates, containing several hundred figures, with colored drawings of the animals of many species.

4. *Die Rizopodi Caratteristeci dei Terreni Sopracretacei*, or *On the Characteristic Rhizopodi of the Supracretaceous deposits;* by G. Michelotti. Modena, 1841.—This valuable memoir contains descriptions of these minute shells from different parts of Europe, and is accompanied by three plates, containing figures of twenty four species.

5. Dr. Mantell will soon publish "Thoughts on Animalcules, or a glimpse of the invisible world, revealed by the microscope, with twelve plates, containing many colored figures of living Infusoria, and occupying about sixteen sheets."

Also by the same author, the seventh edition, with additions, of "Thoughts on a Pebble."

The author's "Wonders of Geology" are ready for a new edition, and he is preparing also, "A Geological Ramble round the Isle of Wight," and "Popular Lectures on the Nervous System."

Dr. Mantell read, May 14, 1845, before the Geological Society, "Notes on the Microscopical Examination of the Chalk and Flint of the S. E. of England."—*See Mag. Nat. Hist., Aug.* 1845.

6. Mr. Murchison's long expected work on Russia, in two quarto volumes, is published.

7. *Report of the Exploring Expedition to the Rocky Mountains in the year* 1842, *and to Oregon and California in* 1843–44; by Brevet

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* The Vienna pound is about one fifth greater than the English, i. e. 100 pounds English=81 pounds Austrian. The loth=one sixteenth of a Vienna pound. The florin=forty eight and a half cents.

Capt. J. C. Fremont, of the U. S. Topographical Engineers. Printed by order of the U. S. Senate. Washington, 1845. pp. 694, 8vo. With maps and plates.—This truly valuable report has reached us at the last moment. The first part we read with equal profit and pleasure two years since, and shall give a more extended notice of both in our next number.

8. *The American Electro-Magnetic Telegraph, with the Reports of Congress, and description of all Telegraphs known employing Electricity or Galvanism, illustrated by eighty one engravings;* by Alfred Vail. Philadelphia, Lea & Blanchard. This is a useful descriptive pamphlet of 208 pages, which is well timed, and will be read with interest by all who watch the progress of human affairs.

9. *Papers on Practical Engineering, (No. 3,)—On Sustaining Walls: Geometrical Construction to determine their thickness under various circumstances;* derived chiefly from a memoir of Mr. Poncelet, with modifications and extensions, by Lt. D. P. Woodbury, U. S. Corps of Engineers.—This is one of a valuable series of scientific papers now publishing under the enlightened superintendence of Col. Totten, Chief Engineer. The labors of the gentlemen of our army in the various departments of science are fast gaining them a well earned reputation.

10. *A History of Fossil Insects in the Secondary Rocks of England, &c.;* by the Rev. Peter Brodie, M. A., F. G. S. London, J. Van Voorst, 1845. pp. 130, 8vo, and 11 plates.—Such books as this are the reward of minute and patient investigation, and mark a mature state in the progress of science.

OBITUARY.

1. It is our painful duty to record the tragical death of Dr. Douglass Houghton, State Geologist of Michigan, which occurred on the night of October 13th, by drowning in Lake Superior. Dr. Jackson has sent us the following letter of particulars, which will be read with melancholy interest by all.

Boston, Nov. 9th, 1845.

Prof. Silliman: *My Dear Sir*—You have doubtless heard of the death of our estimable friend Dr. Douglass Houghton, state geologist to Michigan, and United States surveyor of the public lands in that state. I now communicate to you all that I have been able to learn respecting that melancholy event, which has deprived science of one of her most untiring votaries, the state of her geologist, and his friends of one of the most amiable and true-hearted of men.

Dr. Houghton, in addition to his duties as state geologist to Michigan, had made a contract with the United States government to run the township lines on the public lands of that state, and had employed a number of distinguished surveyors, with their assistants, in performing the difficult and laborious task of the linear surveys, while he explored, so far as his other duties would allow, the geological features of the country over which the survey extended.

He had just been engaged in the important duty of conveying supplies by appointment to his surveying parties, and was returning to Eagle River, when the sad accident befel him which it becomes my painful duty to relate. On the 13th of October, with a party of four trusty French *voyageurs*, in a beautiful sail-boat which had been presented to him by his friends, he was on his way from the portage on the north side of Keweenaw Point to Eagle River, and had just passed a point of land, and was running along the shore to the mouth of the river, when a sudden northeast gale sprang up, accompanied by a heavy fall of snow, and a tremendous cross sea, driving on to a steep and rocky lee shore, obstructed his progress and jeopardized the lives of all who were in the boat. To land on that coast was impossible, for the sea ran as high as his boat's masts, and dashed upon the inhospitable rocks with great fury. The coast at that place consists of conglomerate ledges, dipping boldly into the lake at an angle of nearly 45°, and from ten to twenty feet high. Every exertion was made to keep the boat from being swamped by the sea, which blew directly over its sides. Once when the boat was half full of water, the men bailed it out, and then handed Dr. HOUGHTON his life preserver, entreating him to put it on; but he laid it down at his feet, and said that "there was no danger." This was evidently for the purpose of encouraging his boatmen.

The next moment the boat was filled and overturned. This took place at 8 P. M., three miles from Eagle River, and not more than twenty rods from the shore.

One of the men who had secured a hold on the rudder of the overturned boat, saw a hand rise out of the water, and seizing upon it drew up Dr. HOUGHTON, who after getting hold of the rudder also, pulled off his gloves and said to the man who offered him assistance, "Save yourself—I can get ashore easily."* Soon after a heavy sea struck the boat under her bows, and completely ended her over, and it is supposed that Dr. H. must have been stunned by the blow, for he sank immediately, and was not seen again. Two of his men were drowned with him, and two succeeded in reaching the shore, but were much bruised against the rocks, the sea often carrying them back into the lake after they had gained the shore, and dashing them on the rocks again with violence. At last they succeeded in laying hold of some bushes which grew in the crevices of the rocks, and saved themselves. Only one of the drowned men has been found, and his body was mangled and his brains were dashed out against the rocks. Every exertion was made by Col. GRATIOT, of the Lake Superior Copper Company, to recover the body of Dr. HOUGHTON from the lake, but thus far without success.

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* Dr. HOUGHTON was a good swimmer.

Thus has perished one of the most energetic and active of our state geologists, who lost his life near the scene of his labors, before he had been able to complete the monument of his scientific achievements, and benefit the world by the publication of his volumes of field notes, which must have been filled with important and valuable information.

Dr. HOUGHTON, I understand, was born in Bolton, (Mass.) and emigrated in early life to Michigan. His age was about 45 years. He married young, and has left a wife and several children to deplore his loss. We offer our heartfelt sympathy, and lament with them the loss of a friend, whom we highly esteemed for his many virtues, and uniform courtesy and kindness. C. T. J.

2. Dr. WILLIAM HORTON.—This gentleman, who was well known to all cultivators of mineralogy in the United States, died at his residence at Craigville, in Orange County, New York, some time during the last spring. His inquiries were early directed to the exploration of his own district of country, so rich in rare and curious minerals. He was also for a time one of the geologists who conducted the survey of the State of New York. His latter years were clouded by a chronic melancholy which impaired his previous usefulness. He was a very modest and retiring man; and he has unfortunately left but few written evidences of his scientific acumen. We are unable to give the exact time of his death or his age.

3. WILLIAM C. WOODBRIDGE, long known for his philanthropic labors in the cause of education, died at Boston, Nov. 9, 1845, in the 51st year of his age. He was graduated at Yale College in 1811, and early devoted his efforts to the advance of the educational interests of his country. Being impressed with the opinion that the study of geography might be pursued in a more philosophical manner, he expended much time and labor in the preparation of a treatise on this subject, aided by Mrs. WILLARD. His services in this department were recognized by various Geographical Societies abroad by admission to membership. The "American Annals of Education," established and conducted by Mr. WOODBRIDGE at Boston, enjoyed a high reputation, and contributed very much to incite the measures now every where in progress for the elevation of general education.

THE

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[SECOND SERIES.]

ART. I.—*On Three several Hurricanes of the American Seas and their relations to the Northers, so called, of the Gulf of Mexico and the Bay of Honduras, with Charts illustrating the same;* by W. C. REDFIELD.

(Continued from p. 16.)

Gale or Norther of the Gulf of Mexico in October, 1842.

THIS storm appeared at the southwestern borders of the Gulf of Mexico at the close of September and beginning of October; but from what direction it arrived in that region, does not clearly appear. We may suppose its previous course to have been westwardly, like other storms of these latitudes; and on almost any hypothesis its route must have been, in part, on the nearly adjacent portions of the Pacific Ocean and the gulf of Tehuantepec, a region which has long been noted for its tempestuous character.*

From the region first mentioned, this gale appears to have moved in a northeastwardly or more easterly course through the Mexican sea, across the peninsula of Florida, and over the Atlantic Ocean, touching the Bermudas, till, near the 60th degree of west longitude, it becomes lost to our present inquiries.

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* Vide HUMBOLDT'S New Spain; New York, 1811, Vol. I, pp. 21, 64—66. The Pacific coast of Central America being seldom visited by our navigators, we are unable to obtain reports from that region.

The route of this storm is indicated on Chart I, (track XIII;) and our reports and observations which relate to it are as follows. (See also Chart III; where the localities are indicated numerically.)

1. Weather at Vera Cruz, as per logbook of H. M. S. *Ringdove*:*—Sept. 29, A. M., wind N. N. W., force 4–2, b. c.; P. M., N. N. W. 4, b. c.—N. N. W. 6; o. c. q. r. At sunset struck topmasts and pointed yards to the wind; N. 7, q. r.—midnight, N. 8, b. c. q. Sept. 30th, b. c., wind N. 7; N. W. 5; W. 2; N. N. W. 6–7;—midnight, N. N. W. 6. Oct. 1st, A. M., b. c., wind N. N. W. 5; N. W. 4; P. M., W. N. W. 5, o. c. q.; N. N. W. 7, o. c. q. r.;—midnight, N. N. W. 6, o. c. q. Oct. 2d, A. M., wind N. N. W. 6, o. c. q.; N. W. 5, 4, b. c.;—P. M., N. W. 4; N. N. W. 5, b. c. Wind more moderate on the 3d, but continued N. N. W. and N. W. till about noon of the 4th. [This storm at Vera Cruz was a proper Norther of the Mexican coast, and its duration from Sept. 29th to Oct. 2d, shows its progress to have been very slow at that time. This protracted duration is not unfrequent, but rather common in the Northers at Vera Cruz. This may be ascribed, with probability, to the cessation of the westerly progression of the storm, and the gradual commencement of an easterly course.]

2. The Mexican brig *Secunda Fama* sailed from Vera Cruz on the 29th September. On the 2d of October in sight of the bar, [of Tampico, lat. 22° 15′,] was suddenly attacked by a violent gale of wind, which drove her on a reef of rocks four miles northward of Lobos Island, [lat. 21° 30′, lon. 97° 24′,] where the vessel filled, and those on board lost all hope of escape. On the morning of the 3d the clouds cleared away, and they discovered the Texan sloop of war *Austin* under the lee of the island, whose officers succeeded in reaching the wreck with a life-boat, saved the people, and landed them at Tampico.—(*Marine Report.*) [The shorter duration of the gale here than at Vera Cruz, shows a nearness to its northwestern border.]

3. The schr. *Caroline*, from Metamoras, took the gale at N. E., Oct. 1st, about 100 miles east of the Rio Grand del Norte; the wind first veered eastward, [as the vessel moved southeastward,] and afterwards by N. to N. W. The gale lasted through the 2d of October, and the schr. was driven near to the Campeche Bank.—(*Statement of Capt.* COLLINS.)

4. The brig *Sabine*, for Campeche, went ashore at the Alacranes, on the Campeche Bank, [lat. 22° 30′, lon. 89° 43′,] Oct. 2d, in the hurricane, after cutting away both masts; was left in two feet of water after the sea went down.—(*Marine Report.*)

5. The ship *St. Mary* left the bar of the Mississippi on the 29th of September; on the 30th, wind E. N. E., squally, and a rolling sea *from S. E.*; lat. at noon 26° 33′, lon. 88°: prepared for bad weather. Oct. 1st, at noon lat. 25° 40′, lon. 88° 20′; calms and sudden gusts. Oct. 2d, before daylight the sea ran in all directions, as if at a distance the gale was blowing in a circle towards its center. At noon lat. 25° 20′, lon. 88° 40′; dense clouds in the eastern horizon and a cross sea.

At 7 P. M. on the 2d, after a calm, a tremendous gust from the east struck the ship; the hurricane had now commenced in earnest, and with a force seldom felt. The wind continued without cessation; and early in the morning of the 3d, the ship was hove to under a small storm staysail, which soon blew to fragments. Lat. at noon 24° 10′, lon. 89°;† the wind from the *East* continued to blow without intermission, with tremendous force; the sea ran cross and high, and the deck load was thrown overboard. Shortly after noon the wind veered suddenly to North, and blew with increased fury. The east sea, breaking in upon the decks, swept away from the lashings every movable article, burst in the front of the cabin and filled it with water. About 4 P. M. the wind shifted suddenly to the westward and blew, if it was possible, with still greater fury—the ship now on her beam ends, and the sea making a clear breach over her. It being evident the ship was settling and must soon go to the bottom, the only resource was adopted of cutting away the masts, and the topmasts and foremast went over the side. At 6 P. M. the extreme fury of the tempest ceased, leaving a prodigious sea, and the ship lay during the night a helpless wreck.*

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* For an explanation of Capt. BEAUFORT's meteorological symbols, see note at page 4.

† Capt. FOSTER states that his D. R. longitudes were found too far east, on getting an observation, owing to the strong westerly current then prevailing.

The position at noon of the 4th, by good observations, was lat. 23° 57′, lon. 89° 30′, near the Bank of Campeche.—(*Journal of Capt.* FOSTER.)

6. Barque *Claremont*, from Laguna, on the 3d and 4th of October, lat. 25°, lon. 87°, had a severe gale of wind from S. E. to S. W.—(*Marine Report.*) [The veering of the wind in this case from the eastern to the *southern* and western quarter, the course of the storm being northeastward, shows this vessel to have been on the right of the line pursued by the axis of the gale. The opposite course and suddenness of the wind's changes with the *St. Mary*, show this ship to have been in the left center of the storm, and near the line pursued by its axis; the latter passing between the two vessels.]

7. Brig *Jena* was wrecked in the hurricane on the 4th of October, in lat. 25° 35′, lon. 87°.

8. Barque *Helen Maria* encountered the gale of the 4th-5th of October, off the Balize, and returned on the 12th.

9. Brig *Kanhawa*, from New Orleans, on the 4th and 5th of October, lat. 28°, lon. 86° 45′, experienced a violent hurricane from the east; was hove on her beam ends, lost spars, &c.—(*Marine Reports.*)

It may be perceived that this storm advanced but slowly, particularly on its first entrance upon the Gulf of Mexico. Capt. BUNKER, of the ship *Alabama*, for New Orleans, was hence enabled to avail himself of the strong southeasterly winds pertaining to the right front of the storm, in making a rapid passage from near the Tortugas to within forty miles of the bar of the Mississippi, where he hove the ship to, under the main-topsail only, headed to the southward. His statement continues as follows.

10. At sunset on the 4th, the wind continued increasing, the sea running high, and the barometer still falling, I was led to expect a hurricane, and made every thing doubly secure. The wind had veered to about east, and continued increasing, sounding more like thunder than wind. I looked often at the barometer, which was lower than ever I had seen it. At 3 A. M. of the 5th the foresail got loose, and in spite of all efforts was soon destroyed. I made preparation, for the first time in my life, to cut away the masts; but after getting all prepared, I looked at the barometer again and saw it was rising, and discovering at the same time that the wind had veered northwardly, I ordered the men to turn in for sleep; telling the mates they would want close-reefed sail on the ship by 8 A. M., which was the case as it proved. Was about 80 miles from the Balize at the close of the gale.†

Capt. BUNKER states that the ships which were nearer the north shore did not have the wind so heavy; and that the *Deucalion* of Boston carried double reefs till midnight, in order to weather the south point of the delta of the Mississippi.

11. Ship *Norfolk* for New Orleans took the gale about 200 miles from the Balize, [lat. 27°, lon. 86° 20′?] On the 3d the ship was hove to under bare poles. At 4 A. M. of the 4th was hove on her beam ends, and cut away the mainmast. Lost all the sails but one, with most of the spars, and suffered other damage.

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* Capt. FOSTER states that the carcasses of sea and land birds, in great numbers, were floating in the sea the day after the hurricane. These last could not have come from land to the eastward or even northward of the ship, as the winds then prevailed; but must have been blown from southern Mexico or Yucatan by a gale turning south and east around its axis.

† When Capt. B. hove the ship to, he was uncertain of his latitude, having had no observations for two days.

12. Barque *Eliza Thornton*, from New Orleans, experienced tremendous gales on the 4th, in lat. 27°, lon. 86°. Lost topmasts, bulwarks, &c.

13. Brig *Horace*, from New Orleans, took the gale on the 4th, about 100 miles west of the Tortugas; was thrown on beam ends, lost spars, sails, bulwarks, &c.

14. Ship *Charlotte*, in gale of 4th–5th, lat. 28° 30′, lon. 85°, laid to 18 hours under bare poles: lost spars and sails, and suffered other damage.—(*Marine Reports.*)

The next report enables us to mark the access and progress of the *right border* of the storm, between the Tortugas and the western part of Cuba.

15. Barque *Mallory*, for Campechy, Oct. 3d, off Key West, begins with light airs and variable; A. M. strong breezes from S. S. E. and passing clouds: lat. at noon 24° 24′. P. M. commences with strong breezes from S. S. E. and passing clouds; at 8 P. M. took in the light sails; ends with strong breezes and heavy squalls. Oct. 4th, at 2 A. M. wind *South*; double reefed fore and main-topsail, took in jib and mainsail; 8 A. M. close reefed fore-topsail; forenoon strong gales and head sea; lat. obs. 24° 3′, lon. 82° 40′; P. M. commences with strong gale and cloudy; at 2 P. M. close reefed main-topsail, blowing hard in squalls; at 4 P. M. took in fore-topsail: 6 P. M. *wind S. W.*; wore ship, head to the southward, [which tended to carry the ship out of the gale;] midnight, more moderate. Oct. 5th, at 6 A. M. wind *W. S. W.*; at 8 A. M. made sail by the wind; at noon lat. obs. 24° 36′, lon. 83° 20′; P. M. wind W. S. W., moderate breezes and pleasant weather. Oct. 6th, light airs, and passing clouds; lat. obs. 23° 33′, lon. 83° 20′.*—(*Logbook.*)

16. Barque *Christiana*, from Jamaica for Greenock, lost topmasts, &c. in the gale while lying to under bare poles. [Place not given, but probably in the east part of the Gulf of Mexico, and west of the Tortugas.]

17. Brig *T. Street*, from New Orleans for Jamaica, lost masts, sails, &c. in the gale of Oct. 4th; which increased to a hurricane, and continued so for fifteen hours, from every point of the compass. [Position not given.]

18. Brig *Pantheon*, from Tobasco, [south side of the Gulf of Mexico,] was spoken on the 9th, between Matanzas and the south point of Florida, with loss of main-topmast in this gale on the 4th.

19. Schr. *Fancy* dismasted and wrecked in lat. 26° 15′, lon. 82° 23′, (south coast of the peninsula of Florida,) Oct. 6th. [This nautical date probably refers to the afternoon of the 5th, civil time.]

20. The brig *Ann Eliza*, on the north side of the Gulf of Mexico, off Cape San Blas, [about lat. 29° 30′, lon. 86° 20′,] had the gale severe from N. E. Oct. 5th, veering to N. and N. W.—(*Marine Reports.*)

21. Brig *Samson* came to anchor off St. Marks, Florida, [N. E. border of the Gulf of Mexico,] on the 4th, weather squally from the eastward with much thunder and lightning. Every squall became harder, till at 4 A. M. on the 5th, it was blowing a severe hurricane from E. by S., which drove the brig from her anchors, and continued, varying one or two points eastward, till 4 P. M., when it suddenly died away calm. This lasted about fifteen minutes, when the wind came from N. N. W. and blew with increased fury for about three hours, when it began to abate to a common gale of wind, which after 12 hours moderated. During the hurricane no canvass could stand a minute.—(*Statement of Capt.* SAWYER.) [This account marks the border of the *central lull* of the storm's vortex,

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* It will have been seen that the successive changes of wind on the south side of the *Antje's* gale, in September, were by the west towards the south, the progress of the gale being *westward*, and this the *left* side of the gale. In this October gale, however, which advanced in an easterly direction, the southerly side of the gale becomes the *right* side, and the order of the changes of wind is consequently reversed. Thus, with the *Mallory* the changes of wind were by the south towards the west, successively, while in the other storm, with the *Solway* and *Rover*, the changes were from westward towards the south. These opposite results necessarily pertain to whirlwind gales which revolve from right to left around their axis, while severally pursuing opposite courses.

which, from the statements of Capt. Sawyer, and of other seamen from this part of the Gulf, appears to have passed between St. Marks and Cedar Keys.]

22. At Cedar Keys, lat. 29° 9′, lon. 82° 56′, the hurricane commenced on the 4th from E. and S. E., and continued on the 5th, from S. E. and S., with heavy rain, till late in the night. On the 6th, cloudy and high winds from N. E. The water is stated to have risen 20 feet above low water mark, and within six feet of covering the island. [This shows the powerful effects of the southerly winds in the right side of the gale.]

23. At Apalachicola, lat. 29° 42′, lon. 85° 5′, Oct. 5th, it blew one of the severest gales on record during the whole day. The wind was at its greatest height about 4 P. M. Most of the houses were unroofed.

24. Fort Brooke, Tampa Bay, Oct. 4th, wind E., fair; 5th, storm, wind E. and. N. E.; 6th, N. E. and E., fair.*

25. Pensacola, lat. 30°, lon. 87° 12′, Oct. 3d, wind E., fair; 4th, N., high winds and rain. [This appears as near the northwestern limit of the storm.] 5th, wind E., cloudy,—S. E., fair.

26. Fort Stansbury, lat. 30° 18′, lon. 84° 8′, Oct. 3d, wind N., fair,—S., cloudy; 4th, E. and N., rain; 5th, N. E., rain and high wind; 6th, N. and N. W., rain; 7th, N. E., fair.

27. Fort Fanning, lat. 29° 38′, lon. 83° 9′, Oct. 3d, wind E., rainy; 4th, E., rain and high winds; 5th, N. and N. E., rain and high winds; 6th, N. and N. E., rain and windy; 7th, N. E., fair.

28. Fort Gamble, lat. 30° 25′, lon. 83° 25′, Oct. 3d, S. E., fair; 4th, N. E., rain; 5th, violent hurricane from N. E. with rain; 6th, N. W., cloudy; 7th, N. E., fair.

29. Fort King, lat. 29° 5′, lon. 82° 7′, Oct. 3d, E., fair; 4th, N. E., rain; 5th, S. E., rain with very high wind; 6th, S. E. and E., cloudy; 7th, S., cloudy.

30. Fort Micanopy, lat. 29° 5′, lon. 82° 5′, 4th, S. E., cloudy, N. E., fair, rain at night; 5th, E. and N. E., latter part a hurricane from S. E. and rain; 6th, N. E., cloudy and high winds; 7th, E., cloudy; 8th, E., fair.

31. Fort Shannon, lat. 29° 31′, lon. 81° 47′, Oct. 3d, N., fair; 4th, N., fair,—N. E., rain, (one third of an inch;) 5th, N. E., heavy gale and rain, (two and a half inches;) 6th, S. W. and N. W., heavy gale and cloudy; 7th, N., fair.

32. St. Augustine, lat. 29° 53′, lon. 77° 1′, Oct. 4th, E., rain A. M.; 5th, great gale from the E. and heavy rain. During the evening the wind varied from S. E. to S., and continued with increased violence during the night. Early on the 6th, the wind hauled round to the west, and somewhat abated; but about ten at night it shifted to due N., and blew much severer than had been experienced for years; 7th, N. E., rain; 8th, N. E., cloudy; 9th, S., fair.—(*Meteorological Reports to the Surgeon General.*)

Having crossed the peninsula of Florida with the gale, we again take up the Marine Reports.

33. Capt. Liot, superintendent of the West India line of R. M. steam-ships, informs me that on his return from Nassau (N. P.) to Havanna, after dispatching the Isis, [see 56,] he encountered this gale in some force, on the Bahama Bank.

Barque *Effort*, from S. side of Cuba through the strait of Florida, took the gale on the 6th, lat. at noon, 27° 17′, lon. 79° 30′. At 8 P. M., wore ship and hove to on starboard tack, wind then about N. W. The gale lasted till midnight of the 7th, between N. W. and N. N. W.—(*Statement of Capt.* Davis.) [This vessel, aided by the Florida stream, run into the gale after it entered upon the Atlantic, and being under the lee of the peninsula, would be measurably protected from the right hand winds of the gale, but would encounter it in severity from N. W., as the gale become more advanced. It is usual for vessels coming through the strait of Florida, to keep the Gulf Stream as far as Hatteras, unless driven out of it by stress of weather.]

34. Brig *Delaware* had the gale severe on the 6th, lat. 28° 57′, lon. 79° 27′.

35. Packet *Hayne*, bound south, had a hurricane on the 6th and 7th, from all points of the compass, and was hove on her beam ends: lat. 29° 30′, lon. 80° 30′.

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* Reports from the military posts, Surgeon General's Office.

36. Brig *Caspar Hauser* sailed from Matanzas, Oct. 2d; took the gale on the 5th, lat. 30°, lon. 80°, and on the 6th it increased to a complete hurricane. During the night the gale raged with great violence, making a complete breach over the vessel, which had now sprung a leak. On the 7th, while the gale was still blowing, the crew were taken off by Capt. HUFFINGTON, of the barque *Cowper*, which also suffered in the gale. The *Caspar Hauser* had the gale at N. E., veering to N. W. [This shows the brig to have been in the left side of the storm, or N. W. of its axis line.]

37. Schr. *Maria* had the gale from northeastward; was hove on beam ends on the 6th, lat. 30° 30′, lon. 80°.

38 *a*. Barque *Virginia* was dismasted in the gale and abandoned on the 7th, in lat. 30° 30′, lon. 78° 36′ (?) Gale commenced Oct. 5th, from S. E., and continued increasing till noon; then moderated, to 4 P. M.; when it again came out in a tremendous squall from N. E., and continued till noon of the 6th; when, being water-logged, the officers and crew took to the long boat, and were taken up at 4 P. M. by schr. *Maria*, [last mentioned.] The gale continued through the night of the 6th, and moderated afternoon of the 7th.—(*Statement of* THOMAS TABER, *mate of the Virginia*.)

38 *b*. Brig *Florida Banca*, Oct. 4th, had the wind at E. N. E., veering to E. by S.; lat. at noon, 30° 10′, lon. 79° 15′. Oct. 5th, the gale became severe; lat. 31° 44′, lon. 78° 25′; P. M., gale E. N. E., veering to N. E. Oct. 6th, had the very hardest of the gale, from N. N. E.; lat. 31° 31′, lon. 79° 38′. Oct. 7th, wind north, lat. 31° 30′, lon. 79° 3′; wind abating and hauled to the northwestward.—(*Journal of Capt.* ELDRIDGE.)

39. Brig *Peru*, from New Orleans for Baltimore, took the gale in lat. 32° from E. N. E., which veered to W. N. W.

40. Brig *J. A. Lancaster*, for Savannah, took the gale Oct. 5th, ten miles south of Tybee light, [lat. 32°,] carried away spars, and was drifted as far south as lat. 28° 30′, and was in seven fathoms water off Cape Carnavaral.

41. At St. Mary's, Georgia, lat. 30° 44′, lon. 81° 42′, during the gale the waters rose very high; the streets near the river being several feet under water.

42. At Savannah, Georgia, lat. 32° 8′, lon. 81° 10′, Oct. 4th, wind E., fair. On the afternoon of the 5th, the wind commenced blowing hard from S. E. and E., with rain, until about 4 or 5 P. M., when it shifted to N. E., and increased in violence during the night to a hurricane, and continued, with torrents of rain, to 5 or 6 P. M. of the 6th. On the 7th, wind N. E., fair. 8th, the same.

43. At Charleston, (S. C.) lat. 32° 42′, lon. 79° 56′, Oct. 4th, wind E., cloudy, barometer 30·15. Oct. 5th, N. E., cloudy, the weather giving indications of an approaching gale, barometer 30·20; and at the close of the day, it commenced blowing heavily from E. N. E., which continued during the night. Oct. 6th, in the course of the morning, the wind changed to N. E. and N. N. E., and continued to blow a gale throughout the day, with a very high tide; barometer 30 inches. Oct. 7th, 7 A. M., wind N., fair; barometer 30·15; P. M., N. E., cloudy. [The high state of the barometer at Charleston, shows a proximity to the border of the storm, and perhaps an unusual pressure on this border.]

44. At Wilmington, (N. C.) lat. 34° 18′, lon. 78° 2′, the steamers for Charleston were detained in port during the 6th, on account of the gale.

45. Brig *New Hanover*, two days from Savannah, for Philadelphia, had a tremendous gale from E. to N. E.; laid to 18 hours without canvass, and drifted 150 miles southward of Savannah.

46. Ship *Lucas* left Charleston for Boston on the 3d Oct., and on 6th and 7th, had a gale fron N. E., which blew a perfect hurricane: was blown from Cape Romain, [lat 33° 1′, lon. 79° 24′,] to lat. 31°.

47. Schr. *John Hughes*, from Newbern for Barbadoes, was capsized on the 8th, under a storm staysail; one man taken off the bottom on the 11th, in lat. 33° 1′, lon. 77° 40′.

48. Brig *Philura*, on 6th Oct., in a gale off Cape Fear, was knocked down on her beam ends, and partly dismasted.

49. Brig *Hector*, Oct. 8th, lat. 33°, lon. 76° 25′, in a gale from S. E., [?] sprung the mainmast, lost sails, bulwarks, &c.

50. Brig *Orray Taft*, from Charleston for Providence, on the 4th Oct., was in lat 32° 48′, lon. 77° 11′. On the 7th, 8th and 9th, experienced heavy gales from E. to N. N. E.

We have other reports of this gale "off Cape Hatteras," but otherwise indefinite as to location. At a greater distance from the American coast, we have the following observations.

51. Brig *Francis* reports the gale from N. E. on the 7th Oct., lat. 32° 15′, lon. 73° 20′.

52. Schr. *Currency*, at Philadelphia, Oct. 16th, *from Turks Island*, experienced a heavy gale on the 7th and 8th.

53. Brig *Forrest* sailed from Portland, Oct. 2d, for Havanna. Oct. 7th, had strong breezes from E. N. E., and cloudy; at noon began to take in sail, the wind increasing; at 9 P. M., was under close-reefed main-topsail and reefed foresail, wind E. S. E., with a heavy sea; kept before the wind, both pumps going. At midnight the wind backed to E. by N., and blew a perfect hurricane; lay under bare poles, nearly buried in the sea, until 2 A. M. of the 8th. At 2h. 15m. A. M., a heavy blast capsized the brig: cut away the rigging, when the masts broke and the vessel righted. The crew then lashed to the quarter deck, the sea breaking over them, and remained lashed to the wreck till the 9th, [naut. time?] when the wind shifted to the west, and were taken off on the 11th. The position of the brig is not given in this account, but the wreck was seen, Oct. 15th, in lat. 32° 15′, lon. 71° 50′; having probably drifted, in this time, a degree or more to the southward of her position in the gale.

54. Brig *Sally Ann*, Oct. 6th, lat. 30°, lon. 73°, experienced a violent gale from S. E.

55. Schr. *Betsey Richards*, lat. 30°, lon. 71°, Oct. 8th, experienced a heavy gale from S. E., which lasted 54 hours. On the 9th, shipped a heavy sea, and suffered damage. [The dates here are probably nautical time.]

56. This gale caused the final loss of the R. M. steam-ship *Isis*, near Bermuda, Oct. 9th, which had left New Providence, Oct. 3d, at 8 P. M., for Bermuda, in a leaky condition, caused by striking on the rocks at Porto Rico. In the afternoon of Oct. 6th, a breeze sprung up from E. N. E., which gradually freshened, and at noon of the 7th, it blew a gale, with a heavy sea. The gale was heavy on the 8th and 9th, and on the morning of the 10th, the fires stopped, owing to the strain and increased leaking of the ship, and signals of distress were made to the *Medway*, which ship succeeded in taking off the passengers and crew, about 40 miles from Bermuda. On the 10th, the gale had abated.

57. From Bermuda we have the following report, from the journal kept at the signal station, Mount Langton.

Oct. 3d,	9 A. M.	wind N. 1,	cloudy,	bar. 30·03	Oct. 9th,	1 A. M.	w'd S. E. 9,	c. m. r. q. br.	29·91
	1 P. M.	W.	drizzle,	30·02		9 A. M.	S. E. 7,	c. m.	29·92
4th,	6 A. M.	E. 1,	rain.			noon,	S. E. by S. 8,	c. m. r.	29·91
	9 A. M.	N. 3,	cloudy,	30·02		2 P. M.	S. S. E. 8,	c. m. d.	29·86
5th,	9 A. M.	N. 5,	"	29·99		4 P. M.	S. 7,	c. m.	29·84
6th,	9 A. M.	N. 4,	"	30·03		5 P. M.	S. W. b. W. 8,	c. m.	29·84
7th,	9 A. M.	N. E. 5,	c.	30·13	10th,	8 A. M.	S. W. 4,	c. m. d.	29·96
8th,	9 A. M.	S. E. 6,	b. c.	30·06		noon,	N. W. 3,	c. r.	29·98

[It appears from the above, that the right hand or southern side of the gale passed over Bermuda between the 7th and 10th, the gale being but moderately severe, its axis passing to the north of the island.]

58. The *Sylph*, from New York for Bermuda, encountered contrary winds and heavy weather off that island on the 8th.

59. Brig *James*, for Bermuda, was in lat. 30° 3′, about 270 miles E. S. E. of Bermuda, at 1 P. M. of the 8th, when she first felt the influence of the gale, which increased with strong breezes from S. S. E., and cloudy with passing squalls. Oct. 9th, the wind had veered to S. S. W., and at 4 P. M. the brig was brought to under close-reefed topsails and storm staysails; at 8 P. M. strong wind; at midnight wind W. S. W., squally. At 4 A. M. of the 10th, more moderate; at 6 A. M. made sail, and at 10 A. M. saw Bermuda, 8 miles distant.—(*Logbook.*)

We have no reports from the northern side of the storm at this period, nor any account of its further progress on the Atlantic, though doubtless it must have been met with by many navigators. We may now take a cursory view of the weather on the two borders of the path of the storm.

From the Caribbean sea, we have no accounts that afford the slightest indication of the presence of the storm, either before or after its appearance in the Gulf of Mexico. On the 2d of October, the Brig *Echo* sailed, with other vessels, from Kingston, Jamaica, for Philadelphia, and met with no storm in those seas. So also the *Effort*, from Jamaica, as we have seen, made her first acquaintance with the gale near the northern part of the strait of Florida. There is the same absence of any evidence with regard to the occurrence of this storm at the great chain of the Antilles, and vessels bound northward from these islands, first encountered the gale north of the islands, in its progress to the eastward.

In front of the gale, we find, that in Florida and elsewhere, a mild state of the winds preceded the arrival of the storm, at successive localities; and further eastward, in its route on the Atlantic, vessels were spoken in mild weather immediately before its arrival.

From the left margin of the storm, we have the following reports; some of which afford indications of the effects or influence of the storm.

60. New Orleans Barracks, Oct. 2d, wind N. E.—N. W., cloudy and light rain; 3d, N. W., light rain; 4th, N., cloudy; 5th, N. E., cloudy.

61. Fort Pike, [nearer the storm,] lat. 30° 10′, lon. 89° 38′, Oct. 2d, wind E., cloudy; 3d, E. and S. E., cloudy; 4th, E., fair; 5th, E. and S. E., fair; 6th, S. E., fair.

62. Fort Morgan, (Ala.) lat. 30° 16′, lon. 88° 10′, Oct. 3d, S. E., fair; 4th, N. E. and N., clouds and drizzly; 5th, N., cloudy; 6th, N. E., fair. [An approximation to the storm seems noticeable on the 4th and 5th.]

63. Mt. Vernon Arsenal, lat. 31° 12′, lon. 88° 15′, Oct. 3d, S. W., fair; 4th, N. E., fair, S. E., slight rain; 5th, S. E., cloudy; 6th, N.—S. W., fair.

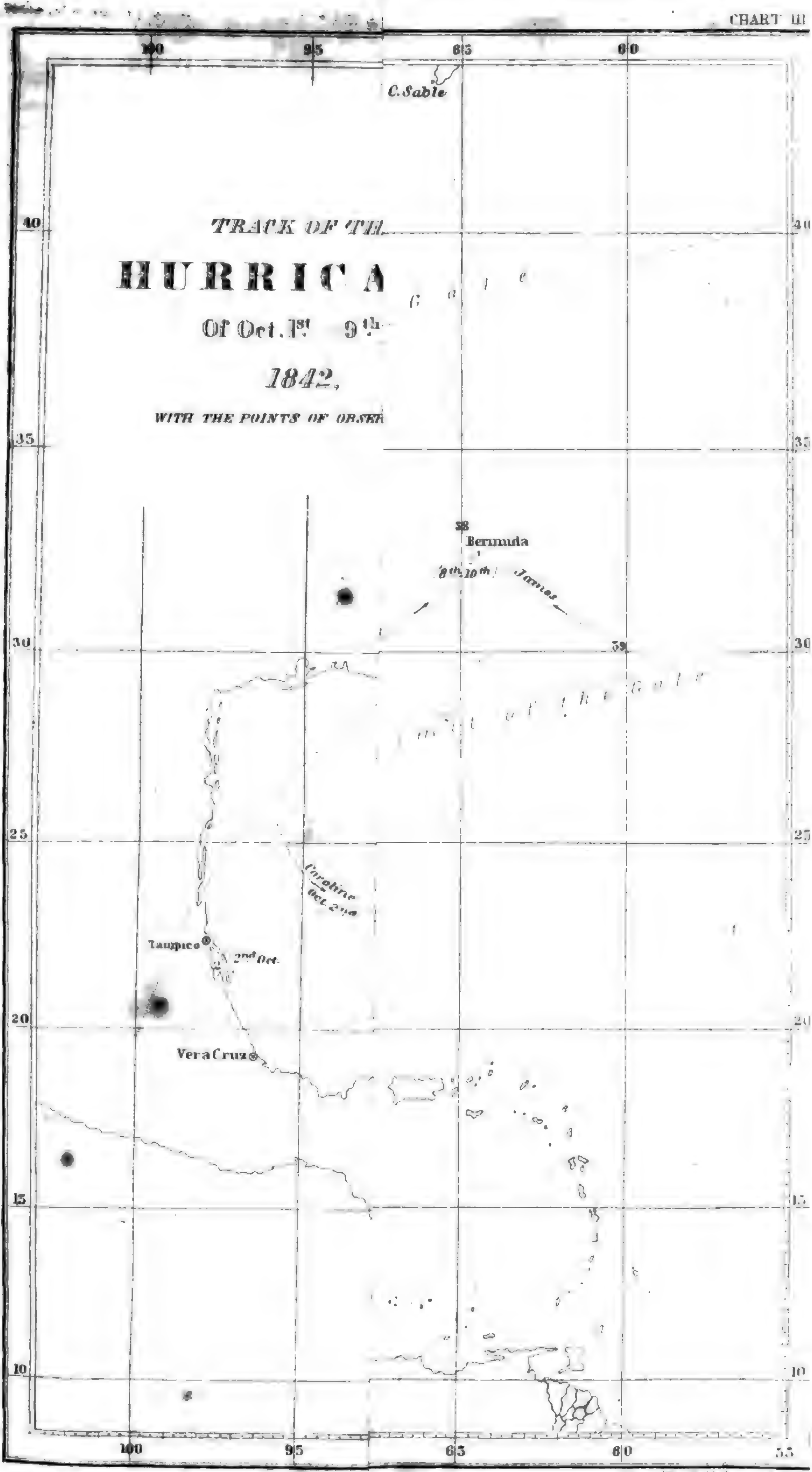
64. Augusta Arsenal, (Geo.) lat. 33° 27′, lon. 81° 30′, Oct 3d, N. E. and E., fair; 5th, E., cloudy; 6th, N. E., fair; 7th, N. E., fair; 8th, N. W., fair.

65. Fort Monroe, (Va.) near Norfolk, lat. 36° 51′, lon. 76° 19′, Oct. 5th, N. E., fair; 6th N. E., fair; 7th, N E., fair, E., cloudy; 8th, S. E., fair; 9th, E., fair.

66. Fort McHenry, Baltimore, lat. 39° 17′, lon. 76° 36′, Oct. 5th, N. W., fair; 6th and 7th, N. E., fair; 8th, N. W., fair; 9th, N. W., rainy.—(*Reports to Surgeon General.*)

At New York, from the 4th to 7th of October, inclusive, in which time the storm had passed this meridian, the winds were light and variable, *the sky perfectly cloudless*, with the barometer ranging from 30·10 to 30·46, averaging 30·289; and no stormy weather occurred till the 14th of the month.

At the magnetic observatory, Toronto, lat. 43° 39′, lon. 79° 21′, from the 3d to 7th, inclusive, calms and light winds prevailed,



Engd by J.M. Atwood N.Y.

mostly with clear weather, the barometer averaging ·158 in. higher than in the preceding month, ·207 in. higher than for the succeeding part of October, and ·212 in. above the annual mean of Toronto.*

But at Bermuda, towards which the storm was moving, the average barometrical pressure during the approach of the storm from the coast of Mexico, was more than one-tenth inch *below* its annual mean. This shows an inequality of pressure of nearly three-tenths of an inch, favoring the route pursued by the storm.

Remarks and Generalizations.

I. Our accounts of this storm are more complete for the northern or left hand side of its axis than on its opposite or southern side, till after it had crossed the Gulf Stream. This seems owing, in part to the course pursued by the gale, and its relations to the common routes of commerce. The less violence of the gale at Vera Cruz than in the heart of the Gulf of Mexico, is in conformity with the usual character of the Northers on that coast, and with the general fact that storms which pass from elevated lands, or even from low countries, do not often act with great force at the surface of the ocean, till at a considerable distance from the coast; this being especially the case with that side of the storm which exhibits an off-shore wind.

II. The rotative character of this gale is well made out by the observed winds as they appear in the several reports, and especially in those of the *Caroline*, *St. Mary*, *Mallory*, *Alabama*, *Samson*, *Betsey Richards*, and at Bermuda, as compared consecutively, and with other parts of the storm, in the proper relations of time and locality.

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* In Sept. 1839, the index readings of my barometer were .015 in. higher than the mountain barometer (No. 33) taken to the Toronto observatory, by Lieut. Riddell, who, while in New York, kindly afforded me an opportunity for comparison. The mean of my barometer for that and the five previous years, at 6 and 10 A. M., 2, 6 and 10 P. M., unreduced, was 30·113 in.; elevation of cistern between ten and fifteen feet above the sea level. The interior of the tube is ·26 in. and my readings have been taken from a point between the summit and line of contact of the column, estimated as equal to a level surface. In 1842 my barometer was removed to another station, some six feet higher; and the later annual means induce a suspicion that the index readings may have slightly lessened since that period; perhaps ·010 or ·014:—but this is by no means certain.

The corrections made in this paper of the index readings of some ship barometers, are the results of rough comparisons made, in this port, with my own barometer.

III. The course pursued by the storm, from its first appearance in the Mexican Gulf, appears to have been northeastward, changing more and more eastward, till on crossing the Florida peninsula, its course was near E. N. E.

IV. The length of its observed track, estimated from Vera Cruz to a point in lon. 62°, is nearly two thousand and five hundred miles. If we consider ten days and a half as the time occupied in passing over this distance, it shows an average rate of progress less than *ten miles* an hour. This will account for the extraordinary duration of this gale, which was not at any time remarkable for the extent of its area: and will account in like manner for the inequality of its observed duration, with the several vessels whose movements were different from each other in direction and velocity. In these respects, this gale contrasts very strongly with one which we have yet to consider.

V. This storm deserves notice as pursuing a more easterly course in the lower latitudes than any other storm which has been traced in the American seas. It shows us, so far as is yet known, the extreme southern route of those Atlantic storms which have a northerly and easterly progression from the Gulf of Mexico or its borders. This peculiarity of the storm, viewed in connection with its previous course from the southwestern extremity of the Gulf of Mexico, has strong claims on our attention.

VI. This gale is alike remarkable for the very southern position which must be assigned to the major axis, or apex, of its semi-orbital path; if we suppose that like other storms, it had a previous westerly course, unreported, in still lower latitudes.

VII. A sufficient cause for the above mentioned course of progression, or for the deviation from a more northern and usual course, is found in the relative states of atmospheric pressure at the time northward of the Gulf of Mexico and in the direction of Bermuda, respectively.

VIII. On the Mexican coast, this storm was properly known as a *Norte* or Norther, and like the usual storms or Northers of that region, it blew from northern points of the horizon, veering towards the northwest before its close.

A Cotemporaneous Hurricane in the Atlantic.

There was a very violent hurricane of short duration, narrow limits and more rapid progress, which passed a little northward of Bermuda near the beginning of the same month. It was encountered, Oct. 2d, by the *Emma*, in lat. 31°, lon. 71°; also, by the *Neptune*, lat. 32° 12′; and by the *Sophia*, lat. 32° 30′, lon. 70°. Next by the *Rienzi*, on the morning of Oct. 3d, in lat. 33° 19′, lon. 67° 32′; and on the same day by the *Cora*, in lat. 34° 10′, lon. 66°. So great was its violence, that nearly all these vessels were dismasted. It is believed that this gale was northward of the Danish island of St. Thomas on the 30th of September, with its border touching this island; and that in its course from thence it curved rapidly northward, to the position of the *Emma*, Oct. 2d, pursuing its course from thence in a northeasterly direction.

Description of the Northers of the Mexican Seas.

The descriptions hitherto given of the storms of this region, seem to be founded chiefly upon phenomena which have been common to particular parts of storms, while moving in certain routes or localities; and hence, as in the case of former descriptions of the West India hurricanes and the storms of the coast of the United States, they have failed to impart any satisfactory knowledge of the general history and progress of these storms.

Mr. MOONEY, an officer of H. M. S. *Thunder*, engaged in nautical surveys, made a passage to Honduras and Vera Cruz in the month of December, 1840, "the very acme of the Northers." He says, "When about 40 miles from Vera Cruz, our forebodings [of the Northers] were realized; we had one of the most severe gales, with the exception of a hurricane, that the West Indies produce, and arrived at Vera Cruz after three days hard battering." Sailing from thence to Tampico, he encountered another Norther, commencing suddenly at N. N. E. Again, on the 11th of January, he arrived in the middle of a heavy Norther at Vera Cruz. Sailed on the 15th, was set to the southeast, "*and thereby escaped a gale that blew to the northward of us.* We had the concomitant swell as long and heavy as usual, but had only light winds, and puffs, and dark lowering weather, with a cross sea, which effectually saved us the trouble of washing ourselves or the deck." Of the Norther he says, "just before it commences the scud can be perceived progressing at no small pace from southeast to northwest.......I think it better for a vessel to keep as near the land as possible on these occasions. The wind blows more along shore—if weather and sky is clear, observations can be obtained. *The gale first lulls in shore, and the heavy dense bank* [of clouds] *can be seen about 20 or 25 miles out*, and there it hangs till the gale breaks altogether, enveloping many a hapless vessel in darkness, *whilst their more in-shore neighbors enjoy comparatively fine weather.*" [I have italicised certain passages in these and subsequent extracts, as having some important bearing. The above is from the Nautical Magazine for 1841.]

Don BERNADA DE ORTA, captain in the Spanish navy, [who is quoted as authority by HUMBOLDT and others,] states that the season in which the *Norths* blow is from September to March, and that the first of the norths is regularly felt in the month of September. In the winter months, after they begin they increase fast, and in four hours or a little more obtain their utmost strength, with which they continue 48 hours; but afterwards, though they do not cease for some days, they are moderate. They come on so frequently that *there are in general not more than four or six days between them.* There are various signs by which the coming on of a Norther may be foreseen—*but the most certain of all is the ba-*

rometer, which at Vera Cruz, in the time of the Norths, varies eight tenths between its highest and lowest range. *The descent of the mercury predicts the Northers*; but they do not begin to blow [at Vera Cruz] the moment it sinks, which it always does a short time *before the North comes on.* Examples are not wanting of the norths happening in May, June, July and August, at which times they are most furious, *being violent hurricanes*, and are called *Nortes del Muero Colorado. They begin at the N. E.*, flying round the compass and *settling at N. N. W.* When the wind begins to veer again towards either the east or the west, the gale will soon be over.—(*See* HUMBOLDT's *New Spain; American Coast Pilot; Penny Cyclopædia, &c.*)

According to HUMBOLDT, both the eastern and Pacific coasts of Mexico are rendered inaccessible for several months by severe tempests, the Norths prevailing in the Gulf of Mexico, while the navigation of the western [Pacific] coasts is very dangerous in July and August, when terrible hurricanes blow from the S. W. At that time, and even in September and October, the ports of San Blas and Acapulco are of very difficult access. Even in the fine season, from October to May, this coast is visited by impetuous winds from N. E. and N. N. E., known by the names of *papagallo* and *tehuantepec.*

It appears in like manner that the coast of Nicarugua and Guatimala, in the Pacific, is visited by violent southwest gales in the months of August and September, known by the name of *tapayaguas*, which are accompanied with thunder and excessive rains; while the *tehuantepec* and *papagallos* exert their violence during a clear sky.

This seems to show that the so called Papagallos, Tehuantepec, and Norther of Vera Cruz, severally, are but the clear weather side of a revolving gale, like the northwester of the coast of the United States; each in its turn being but part of a great vortical storm, which, in certain other portions of its area, or route, often exhibits an abundance of rain.

HUMBOLDT suggested that these northerly winds may blow from the Atlantic and Gulf of Mexico to the Pacific, and that the Tehuantepec and Papagallo, may be merely the effect, or rather the continuation of the north wind of the Mexican Gulf and the *brizottes* of St. Martha. But the vortical character and determinate progression of violent gales was then unknown, and I cannot doubt that the Northers which visit the Pacific coast and the Gulf of Tehuantepec *precede*, in point of time, the same storms in the Gulf of Mexico, and are identical with them, having, commonly, in this region, a northerly progression.

Col. REID says, "it is possible that the Spaniards may apply the term Nortes, or Northers, to more than one phenomenon; but the violent north winds in the neighborhood of Vera Cruz, are frequently no other than the left hand side of rotatory storms, in their northerly progress across the Gulf of Mexico."* In this remark I fully concur.

Identity of Mexican Northers with the Storms of the United States.

When I first ascertained that many of the hurricanes of the West Indies, had visited the Atlantic coast of the United States, and that here they had severally exhibited the common characters either of southeasters or northeasters, according as one or another part of the storm was presented to our observation, it became alike evident, that our storms were far more numerous and frequent than the hurricanes of the West Indies. It was known, also, that the Mexican Northers were of very frequent occurrence, during our most stormy seasons of the year; while it seemed at least probable, that all great storms were governed by one and the same law, deriving their origin from the lower latitudes.

But the presumption naturally arose, that the courses of these Northers would be found generally parallel with the routes of the several storms which had been traced from the West Indies to our Atlantic coast, and that hence, they would, in most cases, prove to be identical with the storms that are found west of the Alleghanies, which sweep over the interior of the United States and the British provinces;—and to a large extent this is doubtless true. But the absence of sufficient observations from beyond the Mississippi, together with the inert character of many storms and the always more intangible or indistinct character of such as pursue their course overland, has hitherto prevented their direct identification with the Mexican Northers by consecutive observations. Nor was I sufficiently aware that the easterly progression of some of these Northers commenced in lower latitudes than in the previously observed cases of the West India hurricanes.

In October, 1837, the steamboat *Home* was wrecked near Cape Hatteras, and having afterwards occasion to investigate the causes of this disaster, I found that the catastrophe occurred toward the close of a northeast gale, that had previously visited the western and northern coasts of the Gulf of Mexico with great violence, and had passed from thence to the coast of North Carolina. In other words, this Norther of the Mexican coast had become, in due course of progression, an Atlantic storm.

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* **Second edition of "Attempt to develop the Law of Storms," &c. London, 1841.**

Racer's Storm of Jamaica, Mexico and Hatteras, in September and October, 1837.

On receiving the second edition of Col. REID's work, in Feb. 1842, I found that his attention had also been drawn to the "Northers," and that he had presented valuable data relating to two storms, the *Racer's* hurricane of 1837, and the storm in which Admiral SOLANO's fleet was dispersed in 1780, both of which he viewed as being related to the proper Northers of the Mexican sea. On recurring to my records of the *Home* storm of Oct. 1837, for the purpose of completing these paragraphs, I perceive that this gale must have been identical with the *Racer's* storm of Col. REID. This extension of its observed route serves to confirm the views which he then expressed; while it becomes important as connecting a Norther of the Mexican coast with first a westerly, then an easterly progression, actually observed, and analogous in character to the known progression of the West India hurricanes. (Chart I, track XV.)

Col. REID's earliest account places this storm at Kingston, south side of Jamaica, on the 26th and 27th of Sept., where vessels were driven from their moorings in such manner as seems to show an easterly gale, veering southeasterly. H. M. S. *Racer* took the gale at E. N. E. near the Grand Cayman on the 28th, which increased to a full hurricane; noon of 29th, lat. 19° 43′, lon. 83° 23′; at 7 P. M. was hove on beam ends, dismasted, and righted with 5½ feet of water in the hold; 9·30 P. M. again hove on beam ends, but righted immediately; midnight, hurricane at its full height; at 2·30 A. M. of 30th had veered to E. S. E., still in full force; noon, lat. 20° 12′, lon. 84° 42′, wind E. S. E. but little abated. Oct. 1st, noon, lat. 22° 22′, lon. 85° 36′, in Gulf of Mexico near Cuba; gale abating. H. M. S. *Ringdove* took the gale early on the 28th, blowing from the eastward, on the south side of Cuba, eastward of Trinidad; 29th, increasing from the E.; lat. 21° 21′, lon. 82° 56′, scudding to the westward; 30th, hard gale from E.; lat. 23° 13′, lon. 86° 32′, in the Gulf of Mexico; 7·30 P. M. shipped a heavy sea, stove weather ports and washed away the binnacles. Oct. 1st, strong gales; 10 A. M. moderating, set close-reefed main-topsail; noon, lat. 23° 16′, lon. 87° 48′, wind E. S. E., under main-topsail, trysails, and fore-stay-sail; morning of 2d, fresh breeze and cloudy; breeze going down. On all this route the phases of the wind show the several observers to have been on the right hand side of the storm's axis.*

I find that the schr. *Active* encountered this hurricane on the 1st of Oct., 47 miles N. of Sisal, (about lat. 22° 10′, lon. 90° 12′,) which lasted thirty eight hours, or, probably, till the morning of the 3d. The schr. *Pomona* which left Sisal in company with the *Active*, was dismasted by it. On the 3d, the schr. *Unber*, from New Orleans, encountered this gale in the Gulf of Mexico and was driven by it to Galveston Island, where we shall find it on the 5th. The schr. *Cora* for Tampico, had the gale severe, in lat. 24°, lon. 93°, which lasted from the 1st to the 6th of Oct., and was greatly injured. On the 2d, 3d, and 4th, the storm was at Metamoras, on the Rio Grand del Norte, lat. 26°, lon. 97° 30′, and along the coast, where it drove the vessels on shore and prostrated all the buildings at the usual port of the Rio Grand. At Galveston, lat. 29° 20′, lon. 95°, the hurricane drove nearly all the vessels ashore on the 5th, where they were left high and dry, as in the neighborhood of Metamoras. The great influx of the sea on this coast, during the gale, is evidently due to the force and extent of the easterly winds on the right hand side of the storm; which, from the vicinity of Metamoras, was recurving eastwardly in its course.

That the storm did not proceed far into the interior in a north-westerly direction from the Gulf of Mexico, is shown by the meteorological reports to the Surgeon General, from Fort Towson aud other western posts. In following its course eastwardly, we find that on the Sabine river, in lat. 30° 51′, lon. 93° 33′, the storm, from N. E. and E., was at its height on the night of the 5th, and continued through the 6th. At New Orleans the gale or hurricane was severe on the 6th, hardest at evening, blowing from S. E. to S., and extending to Baton Rouge and Natchez; at which places it was easterly, and E. N. E., veering north.† At

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* For logs and diagram, see REID on the Law of Storms, 2d edition, pp. 138–146.

† I am indebted to Dr. HENRY TOOLEY of Natchez, for regular files of his valuable meteorological observations, which I have found highly useful in these inquiries: also, to Professors LOOMIS and NOONEY for their observations at Hudson, Ohio.

Pensacola Bay it commenced on the afternoon of the 6th, from the eastward, and veered gradually to the S. on the morning of the 7th, and to the W. and N. W. during the day and evening.* At St. Joseph's, West Florida, the gale was severe on the 7th and 8th, from E. round by S., ultimately to N. W., driving all the vessels on shore except one. At Fort Cass, East Tennessee, and in the upper counties of South Carolina, the storm was violent from N. E., veering N., on the 7th and 8th. The gale was on the coast of North Carolina from the 8th to 10th, blowing from N. E. and extending N. of the Chesapeake; with the barometer, at New York, at a maximum of 30·73 in. on the 9th. From the Carolinas it continued its course on the Atlantic Ocean.

The recurvation of this storm to the eastward, from near lat. 26°, was even more sudden and abrupt than that of the Mexican and Bermuda gale, from a lower latitude, which we have already considered. A like cause also for its sudden deflection and unusually eastern course is found in a *plus* state of the barometric pressure in more northern latitudes, at this period. Thus, at New York during the last ten days of Sept., 1837, the mean of my barometer was 30·324 in., and for the first ten days of Oct. 30·279 in.;† being for the twenty days ·216 in. above the mean for that year.

When once the route of this storm from the Gulf of Mexico to the Atlantic Ocean had been ascertained, it was soon discovered that a similar course had pertained to many other storms from the same regions; but with great inequality as regards their frequency in different years. It was found, also, that this early recurvation of storms at some periods, and their easterly courses in lower latitudes, has an important influence on the weather and climate in the northern portion of the United States. This may be seen in the state of the barometer and weather, which we have shown in two important cases, cotemporaneously with the passage of storms over the southern states; and similar weather usually prevails whenever this peculiar course is pursued by the Mexican Northers. For the intervals between our storms are thereby increased, in extent and duration; and hence it is that we enjoy those placid periods of autumn which are denominated *Indian summers*, of which the cases alluded to are striking examples. This peculiar course of a portion of the Northers was uncommonly frequent in 1837, a year remarkable for the number and severity of its hurricanes. The autumn of 1845 has also been strongly marked by this peculiarity, with fine weather generally prevailing in the northern states, while severe gales have swept the Gulf of Mexico and thence over the Atlantic Ocean; touching Bermuda in several cases, in one of which the body of the storm is announced to have passed to the southward of the island. In fact, storms of this class are found to occur, with variable frequency, at almost all seasons of the year.

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* Logbooks of the United States' Squadron at anchor in Pensacola Bay; on file in the Navy Department, Washington.

† Or a mean of 30·256 in. for the twenty days, *as corrected and reduced to* 30° *Fahrenheit*.

New England Storm of December 15*th*, 1839.

This storm may here be noticed as one of the numerous class of overland storms, which appear to come to us from the interior of the United States and the Mexican territories. In the southwestern and western states this storm comprised the western division of a very extensive but not intense barometric depression, of some days continuance, and like many other storms, was but little distinguished for the development of its anterior winds. The fall of the barometer under these winds, in New York and the middle states, was only about half an inch below the mean of the year. The storm was chiefly remarkable for its violence in New England, on the left side of its axis,—for the extent of the moderate and variable winds about its axis,—for the short duration of the southeasterly and southerly winds of its right front, and for the great extent of westerly winds which were developed in the later part of the gale, which reached even to the border of the trade winds. The route of this storm is now placed on chart I, (track XVI,) in conformity with extensive observations, obtained from the meteorological returns from the military posts, marine reports and other sources.

A number of storms, of greater intensity and more strongly marked outline, may be shown to have pursued a similar course over the interior of our continent and from thence to the Atlantic Ocean. But our attention must next be directed to the Northers which come more directly from the *eastern* portions of Central America.

Art. II.—*Observations on the more recent researches concerning the operations of the Blast Furnace in the Manufacture of Iron;* by Dr. J. L. Smith.

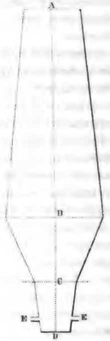
The great difference existing between metallurgic operations of the present day, and those of a former period, is owing chiefly to the ameliorations produced by the application of the science of chemistry to the *modus operandi* of the various changes taking place during the operations, from their commencement to their termination.

Copper and some other metals are now made to assume forms in the chemist's laboratory, that formerly required great artistical skill for their production—the chemist simply making use of such agents and forces as are at his command, and over which he has, by close analytical study, acquired perfect control. Our object at present, is only to advert to the chemical investigations more recently made on the manufacture of iron, treating of those changes that occur in the ore, coal and flux that are thrown in at the mouth of the furnace, and in the air thrown in from below. For most that will be said on this subject, we are principally indebted to the recent interesting researches of M. Ebelman.

The importance of a knowledge of the facts to be brought forward in this article, will be apparent to every one in any way acquainted with the manufacture of iron. It will be seen, that the time is not far distant, when the economy in the article of fuel, will amount in value to the present profit of many of the works. The consequence must be, that many of those works that are abandoned, will be resumed, and others erected in localities formerly thought unfit.

The daily increase of the demand for this article, in the construction of rail-roads and machinery, and the supply of this country falling short of its demands, are directing a large amount of capital towards the construction of furnaces, rolling-mills, and other iron works. The time is not far distant, when the silent influence of our extensive mineral resources will tend more to lay aside one of our great congressional bones of contention, than all the oratory of our statesmen.

It is well known, that the blast furnace is the first into which the ore is introduced for the purpose of converting it into malleable iron, and much therefore depends upon the state in which the pig metal passes from this furnace, whether subsequent operations will furnish an iron of the first quality or not. The interior of the blast furnace consists of three conical cavities, represented by the figure.



A, mouth of the furnace.
AB, fire-room "
BC, boshes "
CD, hearth "
EE, openings called tuyers.

The principal parts of the furnace are thus hastily alluded to, so that those not familiar with their names may readily understand what follows. In putting the blast furnace into operation, the first step is to heat it for some time with coal only. After the furnace has arrived at a proper temperature, ore, fuel and flux are thrown in alternately, in small quantities, so as to have the three ingredients properly mixed in their descent. In from twenty five to forty eight hours from the time when the ore is first thrown in, the entire capacity of the furnace, from the tuyer to the mouth, is occupied with the ore, fuel and flux, in their various stages of transformation.

In order to explain clearly, and in as short a space as possible, what these transformations are, and how they are brought about, we may consider—

1. The changes that take place in the descending mass, composed of ore, fuel and flux.
2. The changes that take place in the ascending mass, composed of air and its hygrometric moisture, thrown in at the tuyer.
3. The chemical action going on between the ascending and descending masses.
4. The composition of the gases in various parts of the furnace during its operation.
5. The causes that render necessary the great heat of the blast furnace.

1. *Changes that take place in the descending mass, composed of ore, coal and flux.*—By coal is here meant charcoal; when any other species of fuel is alluded to, it will be specified. In the upper half of the fire-room, the materials are subjected to a comparatively low temperature, and they lose only the moisture, volatile matter, hydrogen and carbonic acid that they may contain; this change taking place principally in the lower part of the upper half of the fire-room.

In the lower half of the fire-room, the ore is the only material that undergoes a change, it being converted wholly or in part into iron or magnetic oxide of iron—the coal is not altered, no consumption of it taking place from the mouth down to the commencement of the boshes.

From the commencement of the boshes down to the tuyer, the reduction of the ore is completed. Very little of the coal is consumed between the boshes and in the upper part of the hearth; the principal consumption of it taking place in the immediate neighborhood of the tuyer.

The fusion of the iron and slag occurs at a short distance above the tuyer, and it is in the hearth of the furnace, that the iron combines with a portion of the coal to form the fusible carburet or pig-iron. It is also on the hearth that the flux combines with the siliceous and other impurities of the ore. This concludes the changes which the ore, coal and flux undergo from the mouth of the furnace to the tuyer.

If the fuel used be wood or partly wood, it is during its passage through the upper half of the fire-room that its volatile parts are lost and it becomes converted into charcoal. M. Ebelman ascertained that wood at the depth of ten feet, in a fire-room twenty six feet high, preserved its appearance after an exposure for 1¾ of an hour, and that the mineral mixed with it preserved its moisture at this depth; but three and a half feet lower, an exposure of 3¼ hours reduced the wood to perfect charcoal and the ore to magnetic oxide. The temperature of the upper half of the fire-room when wood is used, is lower than in the case of charcoal, from the great amount of heat made latent by the vapor arising from the wood. In the case of bituminous coal, Bunsen and Playfair find that it has to descend still lower before it is perfectly coked.

After the wood is completely charred, or the coal become coked, the subsequent changes are the same that happen in the charcoal furnaces.

2. *Changes that take place in the ascending mass, which is composed of air and hygrometric moisture.*—The weight of the air thrown in at the tuyer in twenty four hours, is twice that of the ore, coal and flux, thrown in at the mouth during the same time.

The air as soon as it enters the tuyer and reaches the first portion of coal, undergoes a change—its oxýgen is converted into carbonic acid, and its moisture decomposed, furnishing hydrogen and carbonic oxide—after ascending a short distance, (12 or 18 inches,) the carbonic acid is converted into carbonic oxide—between this point and the upper part of the boshes it undergoes but very little change, having added to it a further small amount of carbonic oxide. So the ascending column at the top of the boshes is composed of nitrogen, carbonic oxide and hydrogen—from this point it begins to undergo a change; the carbonic oxide diminishes, carbonic acid appears, and goes on increasing for about half the way up the fire-room; after which the carbonic acid, carbonic oxide and nitrogen remain the same, when the hydrogen increases and moisture begins to appear and augment up to the mouth. The ascending mass as it passes out of the mouth, contains the vapor of water, carbonic acid, carbonic oxide, hydrogen and nitrogen. The nitrogen undergoes no alteration in its passage through the furnace, and the same is true of the hydrogen formed at the tuyer.

If wood be used, the gases passing out of the mouth are the same as those just mentioned, with an increased quantity of moisture, and the addition of those pyroligneous products arising from the dry distillation of wood.

In case of the use of bituminous coal, the gases first alluded to, have added to them ammonia, light carburetted hydrogen, olefiant gas, carburetted hydrogen of unknown composition, and sulphuretted hydrogen.

3. *The chemical reaction occurring between the ascending and descending masses.*—From the foregoing statements, we can at a glance see what are the materials to be met with in the different parts of the furnace, and can therefore readily study their reactions upon each other.

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In the upper half of the fire-room little or no chemical action is taking place, the ore, flux and coal, as already stated, simply losing their volatile parts. In the bottom of the upper half and the entire lower half of the fire-room, a reaction is taking place between the ore and the carbonic oxide of the ascending column, iron or magnetic oxide of iron and carbonic acid being the result. It must be borne in mind, that the coal has played no part in this reduction down to the commencement of the boshes. Between the boshes, and in the hearth, no reaction appears to take place between the ascending and descending masses, but the reduction of the ore is completed by the direct action of the coal upon the remaining portion of the undecomposed ore, carbonic oxide being formed, and here is the first consumption of the coal in its passage downwards.

According to M. Ebelman the ore loses in the fire-room $\frac{28}{33}$ of its oxygen by the reaction of the oxide of carbon, and the remaining $\frac{5}{33}$ disappears in the boshes and hearth in the manner already stated, at the expense of from $\frac{6}{100}$ to $\frac{12}{100}$ of the entire amount of charcoal used.

The ore being now completely reduced, unites with a portion of carbon in the hearth, melts at about 13 inches from the tuyer, and descends into the crucible; and here also the flux combining with the impurities of the ore forms the slag which melts.

The coal and the air react upon each other most powerfully just in the neighborhood of the tuyer, where the most intense heat is produced; the oxygen becomes converted into carbonic acid, which acting upon a portion of the ignited coal, is almost at the same moment reduced to carbonic oxide; the moisture of air acting on the ignited charcoal undergoes the decomposition already mentioned, hydrogen and carbonic oxide resulting therefrom.

When the ore is easy of reduction, the gas at the boshes is represented by 100 nitrogen and 52·5 carbonic oxide, *plus* the quantity of carbonic oxide and hydrogen afforded by the moisture.

It must be clearly understood that these rules do not apply to every variety of ore. They are especially applicable to the hematites and such ores as are either naturally porous, or become so in their passage through the fire-room of the furnace, thus increasing the surface of contact exposed to the action of the reducing agent, (carbonic oxide,) so that when it has reached the boshes the reduction is nearly complete.

The specular, magnetic, and siliceous ores are reduced with much more difficulty; most of the ore in these cases reaching the boshes but slightly altered, they being principally dependent upon the direct action of coal for their reduction; this circumstance largely increases the consumption of coal when any of these ores are employed; and the amount of caloric made latent, in consequence of the reduction requiring the direct action of the coal, is very great, whereas in the reduction of the ore by carbonic oxide no heat becomes latent: for the heat rendered latent by the oxygen of the ore becoming gaseous, is compensated by the sensible heat produced by the combination of the carbonic oxide with the oxygen. Where the reduction is produced by the carbon, with the formation of carbonic oxide, 1598 unities of heat are made sensible, while 6216 are rendered latent, giving a difference of absolute loss of 4618.

It should be the object of the metallurgist to reduce as much of the iron as possible by the oxide of carbon. Magnetic, siliceous and other hard ores should be reduced to smaller fragments than those softer and more easily managed. Were it possible to reduce them to powder without the danger of choking the furnace, it would be all the better, as the great object is to have a large extent of surface exposed to the carbonic oxide. The different capacity of different ores for reduction, shows the necessity of having furnaces of different dimensions for them respectively.

The matter which covers the melted metal in the crucible, and that which adheres to the interior of the hearth, contain silicate of iron and charcoal in a pasty state, and there is consequently a constant reduction of the oxide of iron, which gives rise to carbonic oxide; this gas bubbles through the slag, which if drawn off at this time, will, when cold, present a porous structure, a sure indication that the furnace is not working well and that the slag itself contains much of the ore in the form of a silicate.

4. *Composition of the gas in various parts of the furnace during its operation.*—The analyses lately made by Ebelman are the most accurate and best detailed that we are in possession of. What follows has reference to a furnace worked with charcoal.

Gas taken from the mouth of the furnace and dried.

Carbonic acid,	12·88
Carbonic oxide,	23·51
Hydrogen,	5·82
Nitrogen,	57·79

The vapor of water in a hundred volumes of this gas, varies from nine to fourteen volumes. Examinations made at different times show the proportion of hydrogen and nitrogen to be nearly uniform, and that the sum of the volumes of carbonic acid and carbonic oxide is constant, but that there is a variation in their respective proportions.

Gas taken from the interior of the fire-room at 5 *to* 10, *and* 13 *to* 17 *feet from the mouth, (fire-room* 36 *feet.)* From five to ten feet, the proportion of moisture diminishes, the other ingredients remaining about the same. From thirteen to seventeen feet, the proportion of carbonic oxide increases, while the carbonic acid and hydrogen diminish.

Gas from the bottom of the fire-room and top of the boshes. This is remarkable for the constancy of its composition, and for the absence of carbonic acid and watery vapor. Composition—

Carbonic oxide,	35·01
Hydrogen,	1·92
Nitrogen,	63·07

Gas from the bottom of the boshes and commencement of the hearth.

Carbonic acid,	0·31
Carbonic oxide,	41·59
Hydrogen,	1·42
Nitrogen,	56.68

Gas from the neighborhood of the tuyer.

Carbonic oxide,	51·35
Hydrogen,	1·25
Nitrogen,	47·40

The two last statements would appear to contradict the rules previously laid down, as regulating the operation of the blast furnace; for, according to them, the proportion of carbonic oxide at the top of the boshes should be a little greater than in the hearth, whereas the reverse would appear to be the case by the analyses here given. Besides, from a glance at the composition of the three last gases alluded to, it would appear that the gaseous products, as they ascended the furnace, lost completely a portion of the carbonic oxide, without a replacement by carbonic acid or other compound; in other words, a portion of it would appear to be completely annihilated, which of course is an impossibility. This apparent anomaly is easily accounted for, when it is stated how the gas was collected.

In order to obtain the gas from different portions of the furnace, holes were bored into the side, and a tube inserted, by which it was drawn off. Allusion has already been made to the fact that a pasty mass adheres to the sides of the hearth, containing silicate of iron and charcoal, in which there is a constant reduction of the iron, with the formation of carbonic oxide. Now it is evident that the gas drawn off by a hole bored into the side of the hearth, will be largely mixed with this carbonic oxide forming in the immediate neighborhood of the opening, and that it cannot serve as an index to the character of gas passing through the centre of the hearth. M. Ebelman was aware of this fact, but he was not able to overcome the difficulties in the way of obtaining the gas under the proper circumstances.

Gas taken at the tuyer.—Here it is little else than atmosphere mixed with a few per cent. of carbonic acid.

From these results it will not be difficult to admit, that the oxygen of the air is converted immediately into carbonic acid, which is rapidly changed into carbonic oxide under the influence of an excess of carbon and the high temperature developed near the tuyer.

5. *The causes that render necessary the great heat of the blast furnace.*—The weight of the ore, flux and combustible, which enters the furnace, being only one half that of the ascending column, and as the specific heat of these three materials is very much below that of the gas of the ascending mass, it is not the heating of them that explains the necessity of the very great heat of the blast furnace. But the principal cooling causes are—

1. The drying of the ore, flux and coal, and the expulsion of carbonic acid from the flux, &c., rendering much of the heat latent; for what was solid is now transformed to the gaseous state.

2. The reduction of the ore, or in other words, the transformation of the solid oxygen of the ore into gaseous oxygen. If the ore has been deprived of its oxygen by the action of carbonic

oxide, with the formation of carbonic acid, the heat rendered latent by the oxygen, is compensated for by the heat developed by the reaction between the oxygen and carbonic oxide; which is the character of the operation that principally takes place in the lower part of the fire-room. If the ore has been deprived of its oxygen by the direct action of the coal, the amount of heat rendered latent is enormous, as already stated; for carbonic oxide is the result of this reaction, and the amount of heat developed by it falls far short of that rendered latent by the oxygen that has entered into its formation, assuming the gaseous condition,—this is the character of the reduction taking place in the boshes and hearth.

3. The conversion of the carbonic acid near the tuyer into carbonic oxide, has a powerful influence in cooling the upper part of the hearth; for of the 6260 units of heat formed by the first action of the air upon the coal, 4662 are rendered latent by the conversion of this carbonic acid into carbonic oxide.

This terminates what it was proposed to treat of; it is little else than a sketch of the chemistry of the blast furnace, sufficient to show its importance.

In a future article, some remarks will be made upon the amount of combustible lost in the operation of this furnace, the recent methods employed to prevent this loss in the complete combustion of coal, the action of the hot blast, theory of the refining furnace, charring of wood, and other points of interest.

Charleston, (S. C.) Nov. 26, 1845.

ART. III.—*Genera of Fossil Corals of the family Cyathophyllidæ.*

THE following pages on the Cyathophyllidæ are cited from Mr. DANA's work on Zoophytes, one of the volumes of the Exploring Expedition series.* This work embraces all known species of recent zoophytes, exclusive of the Actinidæ, Bryozoa and Sertularidæ, including about 500 species, nearly half of which are for the first time described. The collections of the Expedition were quite extensive, as their opportunities for making them were peculiarly favorable. The investigations, which extended to the animals of numerous species, suggested so many changes and modifications in various parts of the received systems, that the work necessarily became a complete treatise on Zoophytes. The genera of fossil corals are mentioned in the places where they fall in the classification adopted, with their characteristics. We do not propose to review the work, as Mr. Dana will furnish for future numbers of this Journal a series of articles upon Zoophytes, made up in part from his Treatise; and this we believe will be more acceptable to our readers, especially as only a small edition of the work has been published.

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* United States Exploring Expedition, during the years 1838–42, under the command of CHARLES WILKES, U. S. N. Zoophytes, by JAMES D. DANA, Geologist of the Expedition; 741 pp. 4to, with a folio atlas of 61 plates. 1846. The atlas is not yet published.

In the following citations, we omit the Latin descriptions.

Family CYATHOPHYLLIDÆ.

Caryophyllacea forming calcareous coralla. Gemmation inferior, the buds either lateral or growing upward from the summit. Corallum of a polyp usually transversely or obliquely septate at middle.

The species of this family are so nearly related to one another, and the transitions uniting the widest variations from the type are so gradual, that they have generally been classed together, and originally, a large part constituted a single genus. Yet as the characteristics of the family can be drawn only from fossilized coralla, there is much difficulty in seizing those peculiarities which will satisfactorily exhibit its unity. Moreover, the early forms of organic life had generally a wider range of characters than those of the present day, and seem to have belonged rather to the system of the period than to that now existing.

The coralla* of the Cyathophyllidæ have usually the structure of the Astræidæ, with the inferior mode of budding of the Caryophyllidæ; in the general character of the stars, and the numerous intermediate dissepiments uniting the lamellæ, many of them are near the former, while others have the simple stars of the latter. The most striking characteristic in structure consists in the transverse septa and cellules, which constitute the middle of the corallum; in this respect the species most Astræoid, usually differ widely from true Astræas. Many of the species are simple, and in consequence of their not budding, their connexion with the group is determined by analogies in general structure, and by their transitions.

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* Mr. Dana uses the word *corallum* in place of *polypary* or *polypidom*. The latter words imply that the coral *contains* the polyps in its cells, whereas in fact, there is no more propriety in such a statement than there is in saying that a man is contained in his skeleton. Corallum was used by some ancient writers, and is sufficiently distinct from Corallium, the name of a particular genus of coral zoophytes.

While in a transverse section, the star of the Astræidæ and Caryophyllidæ characterizes a large part of the group, there are others closely allied, (Cystiophylla,) in which the lamella or rays, are barely traceable about the center of the cell, and are lost outward in a general cellular texture; and in some of the same group, the rays are wholly wanting, and the texture of the corallum, in a transverse section, is simply porous or spumous. It is quite probable that this absence of distinct lamellæ, and the cellular texture instead, may depend, as in the Porites and Goniopore, on the polyps being long exsert when expanded, only their lower portions, below the visceral cavity, secreting lime.

In a vertical section, the transverse septa are sometimes seen to extend quite across the whole interior, while in other species they are confined to the middle portion, or become almost obsolete. They are seldom regular in their intervals, or in a simple range; on the contrary there is commonly a confusion of transverse cellules through the center of the corallum. In several species, the septa, instead of crossing transversely, are oblique, and merely overlap about the medial line; while in others they extend upwards very obliquely from either side, and meet more or less perfectly in an axis to the corallum. Something apparently analogous to this is seen in certain Astræas; the lamellæ instead of being finished out entire, have the inner edge pectinated obliquely upward, the pectinations extending toward a medial line. Yet the Cyathophyllidæ differ essentially in having, for these oblique lines, prolongations of the intermediate dissepiments which unite the lamellæ, and not of the lamellæ themselves. It appears to be a general principle, that while these intermediate dissepiments are altogether subordinate to the lamellæ in the Astræidæ, in the family under consideration, they are usually stouter than the lamellæ; the transverse septa alluded to, result from their continuation, and more or less perfect union, through the central portions of the corallum, where the radiating lamellæ are often wanting. The axis, in the species with oblique ascending septa, is sometimes formed by a convolution of the septa or plates, as shown in some Columnariæ. In the Sarcinulæ the septa extend quite from the sides, and appear like a series of funnels inverted upon one another, with a solid axis along the central line.

Michelin first pointed out that certain species have on one side of the cell a narrow triangular depression or cavity, with one or more of the lamellæ in part wanting, and designated the group *Caninia.* This structure cannot be considered altogether anomalous, when we consider that some Madreporæ and Zoanthidæ have one tentacle different in size or color from the others; and we need not look for an explanation of it to an analogy with the siphuncle of the Ammonite.

We observe a farther difference between the coralla of the Astrææ and the Cyathophyllidæ. In the former, when the cells are *not contiguous*, the limits of the stars are formed by a thickening and lateral coalescence of the radiating lamellæ; and the interstices in a transverse section, constitute a narrow band, often cellular, between the several stars; but in the latter, although there may be broad interstices between the cells, there are none between the stars; they are separated only by a simple thread-like line. The lamellæ, or their portions towards the circumference, often become subdivided, as in some recent Caryophyllidæ. It appears therefore that there is a decided difference in the structure of the polyps. In Astræas with *contiguous* cells, we have in a transverse section nearly the same structure as in the Cyathophyllidæ; but, unlike the species of the group before us, they are dichastic in budding, the disks of the polyps generally subdividing by growth. The interstitial buds of this family are in character like those of the Porites and Astroites, in which budding is lateral. The summit buds of the Cyathophyllidæ differ decidedly from the disk-buds of the Astræas. Their production is attended with a sacrifice of the parent, and they consequently grow up as prominent young, like the lateral buds of a Caryophyllia; while in the Astræas, without the intermitted mode of growth and reproduction, and a prolate growth of the summits, the young and parent grow on together with an equal rate of increase.

The Cyathophyllidæ afford examples of both aggregate and segregate Zoophytes. Some species form clumps of branches like those of many Mussæ and Euphylliæ; while in others, the adjacent polyps coalesce and produce solid massive forms. In a few, the polyps are crowdedly in contact without coalescing, (or are united by their non-secreting exterior,) and in consequence of the mutual pressure, have a prismatic form; and the coralla, though apparently solid, may be readily broken into prisms. The same genus, as in other departments of Zoophytes, may contain both solid, branching, and also simple or non-budding species.

A study of the internal structure of these corals, has led the writer to some changes in the received limits of groups, and also to the introduction of one or two new genera. The generic names of older authors have, in some instances, of late been misapplied; in obedience to the principles relating to nomenclature, digested and brought out by the British Association, a restoration to their original characters has been attempted; and where impracticable, their rejection seemed preferable to retaining them with altered characteristics.

Other errors have arisen from regarding external forms too implicitly, in drawing out generic distinctions. Thus the genera Lithodendron and Columnaria, as employed, include species which are true Cyathophylla, and some allied species have been referred to the genus Caryophyllia (Cladocora, of Ehrenberg,) although differing totally from them and all others of the Caryophyllidæ, in the transverse structure of the interior.

The following are the genera of this family, with their characters. In presenting this review of them, the author is aware that the subject requires much farther study before its difficulties will be wholly removed. We may subdivide them into the following groups.

1. *Those with the cross septa transverse or but little oblique; sometimes nearly or quite obsolete.* Includes the genera Cyathophyllum, Calophyllum, Amplexus, Caninia, Acervularia, Arachnophyllum, Cystiophyllum.

2. *Those with the septa very oblique upward, and converging to a central line, with sometimes a distinct axis.* Includes the genera Clisiophyllum, Michelinia, Columnaria, and Sarcinula.

I. *Transverse septa straight, or but little oblique, sometimes becoming obsolete.*

Genus 1. CYATHOPHYLLUM. Quite simple, ramose or glomerate. Corallum within transversely septate; cells concave, regularly stellate; numerous intermediate dissepiments uniting the lamellæ, and the outer portions of the corallum of a polyp, consequently, regularly cellular.

The type of this genus is the *Cyathophyllum dianthus.*[*] The texture of the interior at middle is transversely septate, while either side of this medial portion the texture is cellular. In some species the cellular portion is very narrow, and these form a transition to the genus Calophyllum; this texture may in all instances be perceived on polishing down the exterior, when the surface will appear cellular as described; and the cellules are mostly nearly rectangular. The transverse septa are occasionally much convex.

In the *dianthus* the intermediate dissepiments run obliquely from above *downward and inward;* and the same is true of many other species. There are others in which these dissepiments run *upward and inward*, and as the species have also some difference of habit, they constitute at least a subgenus, if not a wholly distinct group. The name *Heliophyllum* has been applied by Mr. James Hall to a specimen of this kind in his cabinet, and may well be retained. It is represented in his New York Geological Report, fig. 3, p. 209, and is probably near the Cyathophyllum helianthoides of Goldfuss, pl. 20, fig. 2.

The subgenus Heliophyllum will then contain species having generally the transverse septa of the Cyathophylla, but with the intermediate dissepiments running oblique *upward* and inward.

Both solid, ramose and simple species, are included among the Cyathophylla; and we do not deem it necessary to separate the cylindrical and prismatic species, which have a similar internal texture, although heretofore referred in part to the genera Lithodendron, Columnaria, and Caryophyllia. Should they be separated, a new genus should be constituted, as they are not true Caryophylliæ, nor Columnariæ; neither do they belong to the Lithodendrum of Schweigger.

Genus 2. CALOPHYLLUM, *Dana.* Quite simple, caliculato-ramose or aggregate. Corallum within transversely septate; cells concave, regularly stellate; no internal dissepiments between the lamellæ, and the sides of the corallum, therefore, not cellular.

The Calophylla pass gradually into the Cyathophylla, but still may be readily distinguished by polishing down the exterior to a depth of a line, when the edges of the vertical lamellæ within are brought into view, and the absence of intermediate dissepiments is apparent. The lamellæ of the cell sometimes appear split open or subdivided towards the sides, and occasionally dissepiments may be distinguished between the separated parts, when not apparent between the several lamellæ themselves.

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[*] **See Murchison's Silurian System, pl. 16, figs. 12, 12*b*; also figs. 9, 10, 11*a*.**

Genus 3. Amplexus, *Sowerby.* Stems subcylindrical, uneven. Corallum within transversely septate, septa very broad and nearly straight, extending quite to the sides; cells many rayed.

The species of Amplexus are distinguished by their uneven cylindrical forms, having the internal septa extending quite across the whole interior. They are thus closely related to the Calophylla, and it may be a question whether the two genera should not be united in one, unless it is thought best to pursue the system, apparently impracticable, of forming separate groups of the cylindrical, columnar, and massive species of the genus Cyathophyllum.

The name *Cyathophora* has been applied by Michelin to fossil corals near the above, but massive in structure, and the rays obsolescent. They are often prismatic, like the Favosites, though larger. They may be viewed as massive species either of Amplexus or Calophyllum.

Sowerby, *Mineral Conchology*, i, 165, pl. 72. Phillips, *Palæozoic Fossils*, p. 7, pl. 3, fig. 8. Michelin, *Icon. Zoophyt.*, 104, pl. 26, fig. 1. Michelin's genus is thus characterized by him: Fixum, glomerato-globosum vel ramosum, tubulosum; superficie cellis immersis; cellis sparsis, per diaphragmata transversa divisis, distinctis, obsoletè stellatis; lamellis subnullis. The species referred to the genus is from the Oolite.

Genus 4. Caninia, *Michelin.* Quite simple or aggregato-gemmate. Corallum within transversely septate; cells concave; one or more rays of the star on one side obsolete, and the transverse septa beneath this part having a funnel-shaped depression; general texture like that of the Calophylla.

This genus, instituted by Michelin, includes a few species of Cyathophylla with a depression on one side of the star, and some appearance like a siphuncle. The depression is apparent in all the transverse septa below. Koninck doubts the grounds on which the genus is founded; but Michelin states that he has observed the characteristic in a large number of specimens. Good drawings of it are given in his *Iconographie Zoophytologique*, pl. 16. This peculiarity has not been observed in any massive species.

Genus 5. Acervularia, *Schweigger.* Ramose or aggregate. Corallum imperfectly transverse septate, or not at all so; cells acervately proliferous.

The Acervulariæ have a small cup-like cell, prominent within the summit and forming its centre, and are very proliferous from the summits. The characters of the genus require more study before it can be considered as established on sufficient grounds.

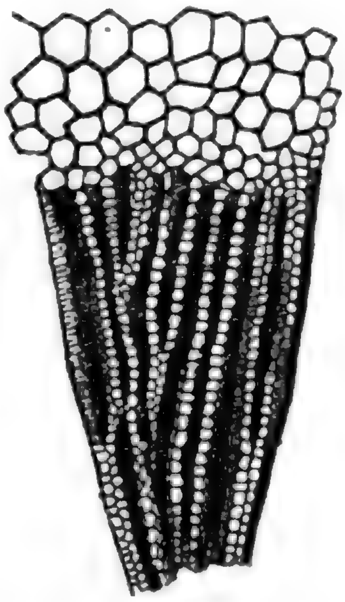
This genus was instituted by Schweigger for the species figured by Fougt in the Amœnitates Academicæ, (Corall. Balt., i, tab. 4, fig. 9, and No. 2,) and thus described by him: "Madrepora composita, corporibus proliferis e centro pluribus, undique coadunatis; stella convexa, centro concava." The genus is characterized as follows by Schweigger, (Handbuch, p. 418:) "Stirps calcarea, e conis approximatis: coni e cellulis lamellosis acervati omnes cellula terminali medio protracta, e centro depresso prolifera;" which may be translated: Calcareous, and made up of approximate cones; cones acervate and proceeding from lamellate cells, which have a terminal cell at middle, and are proliferous from this depressed centre. He names the species *A. baltica.* The essential characters of Schweigger's genus are retained in the above generic description. The convexity of the summit exterior to the cup-like centre, is not a universal character. The *Astræa ananas*, figured by Lonsdale, (Silurian System, pl. 16, fig. 6,) appears to belong to this group as here characterized; but his *Acervularia baltica*, which differs from Schweigger's, is the type of another genus.

The *Strombodes* of Schweigger may also fall in part into this genus. The peculiar structure attributed to the species, the formation of successive *layers* of cells, appears not to be of generic importance. He thus characterizes the genus: "Stirps calcarea, e cellulis lamellosis in conos acervatis, strata horizontalia constituentes. Coni paralleli, e cellula cyathiformi prolifera." (Handbuch, p. 418; see also Goldfuss, Petrefakten, 62, pl. 21.) The name is from *στϱομβος*, *a top*, and refers to the inverted cones constituting the layers. Blainville changes the name to Strombastræa, (Man. d'Actinologie, p. 376.) The Strombodes of Ehrenberg includes those *solitary* Cyathophylla of Goldfuss, which from their peculiar interrupted mode of growth appear to consist of a series of inverted cones, ("tanquam conis e centro proliferis.") The species "Ringel-Coralle," pass so gradually into others, with a nearly smooth exterior, that the character can hardly be considered as of sufficient importance for founding a genus. Ehrenberg includes in his genus a recent species from the Red Sea, which I have referred to under Euphyllia.

Lonsdale and Phillips apply the name Strombodes to species which have the lamellæ twisted about the centre, deriving the name from *στϱεφω*, to *twist*, thus departing widely from the original signification of the word and genus, as introduced by Schweigger, (Pal. Fossils, p. 10; Sil. System, 691, pl. 16 *bis*, fig. 4.) If the genus or its name merits a place in the science, Schweigger's characteristics of it should be to some extent retained.

Genus 6. Arachnophyllum, *Dana.* Aggregate Cyathophyllidæ, having the cells faintly radiate, (the rays often obsolete towards the margin;) texture of the corallum for the most part cellular; of the radiating lamellæ, very minutely cellular.

Fig. 1.



This genus includes the *Acervularia baltica* of Lonsdale. The faint rays and the general texture seem to show a relation to the Cystiophylla. The rays under a microscope appear very delicately cellular, like the finest lace-work, instead of being solid plates, as is shown in the annexed cut, representing part of a section much enlarged. The stars, or separate polyps of a zoophyte, are usually without prescribed limits in the interior of the corallum. (Sil. System, pl. 16, fig. 8 to 8*e*; Schweig., Handb., p. 418.)

The absence, on a polished transverse section, of circumscribed limits to the stars, which appears to be a general characteristic, shows some relation to the Fungidæ, and the species may prove to belong to the tribe Astræacea; yet it is probable that the polyps were prominent as in the Porites, and that the budding was lateral or inferior, instead of superior. The texture below the centre of a cell is very imperfectly, if at all, transversely septate.

Genus 7. Cystiophyllum, *Lonsdale.* Quite simple or ramose Cyathophyllidæ. Corallum not radiate, or rarely with distinct rays about the central area; texture of the sides, and usually of the whole corallum, spumoso-cellular.

The peculiar cellular structure of these species may at once be detected in the character of the lateral surface, especially after polishing off the exterior, if not before, when the cellules will be found to differ strikingly from the rectangular cellules of the Cyathophylla.

The species are usually without rays to the cells; yet in some, faint lines may be perceived around the central area, and a transition may be thus traced to the Cyathophyllum structure. The absence of transverse septa along the middle of the corallum has been laid down as a characteristic of the genus, yet it is not universal; and we perceive here, also, progressive transitions towards the Cyathophylla.

II. *Transverse septa converging upward into an axial line.*

Genus 8. Clisiophyllum, *Dana.* Quite simple, ramose or aggregato-glomerate. Corallum having the cells radiate; texture internally at middle consisting of septa and cellules converging upward, but without a distinct axis; texture exterior to this middle portion cellular.

This genus includes many of the so-called Cyathophylla, both simple and massive species. In internal structure they resemble the Michelinïæ, but differ in having the structure small cellular exterior to the central convergent portion. The bottom of the cell has usually a pointed conical prominence, proceeding from the character of the septa within; and about this centre the lamellæ sometimes appear twisted. These species with twisted lamellæ may constitute, in part, the genus Strombodes, as this name is used by Phillips and Lonsdale. The name is from the Greek *κλισιον*, *a tent*, and alludes to the ∧-like figures which are made by the converging lamellæ about the centre, as seen in a vertical section. The first of the annexed figures represents a simple turbinate species, resembling externally the Cyathophylla. The other (fig. 3.) is from a massive Astræoid species.

Fig. 2.

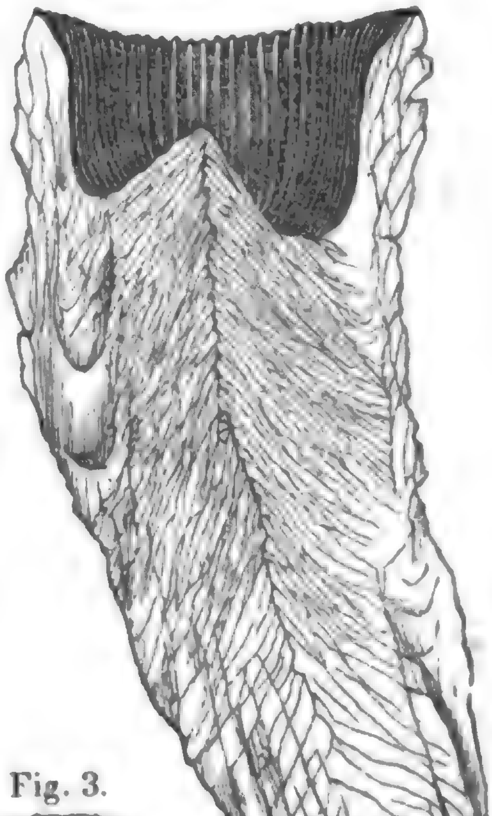
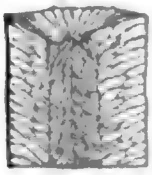


Fig. 3.



Genus 9. Michelinia, *Koninck.* Aggregate Cyathophyllidæ. Corallum with excavate cells; texture of the whole interior characterized by oblique irregular septa, converging upward toward an axial line; axis none.

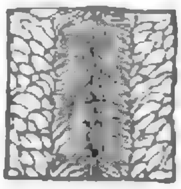
This genus was instituted by Koninck. The species have the internal structure of the Clisiophylla, except that there is no regularly cellular structure exterior to the central convergent portion. They differ from the Sarcinulæ in having no axis. In the Michelinia tenuisepta (Calamopora tenuisepta of Phillips) the general structure of the corallum is columnar.

Phillips, *Geol. of Yorkshire*, ii, 201, pl. 2, fig. 30; Koninck, *Desc. des Anim. foss. des terrains houillers de Belgique*, 31, pl. C, figs. 3*a*, 3*b*; Michelin, *Icon. Zoophyt.*, 83, pl. 16, fig. 3.

Genus 10. Columnaria, *Goldfuss*. Glomerate; polyps laterally in contact, and consequently prismatic. Corallum having the cells radiate, texture internally at middle consisting of oblique septa and cellules converging upward into an axis; texture exterior to this middle portion, cellular.

In a transverse section of the Columnariæ, the outer portions are cellular, as in the Cyathophylla and Clisiophylla, while the inner consist of oblique septa converging upward into an axis; and this axis appears sometimes to be made by a convolution of the septa, or their partial coalescence. Excepting the existence of an axis, the species are similar in their essential characters to the Clisiophylla. The columnar forms into which the coralla break, by a separation of the prismatic cells, are supposed to characterize all the species of the genus; yet as this is not necessarily of generic importance, it may prove otherwise.

Fig. 4.



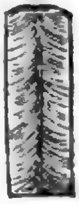
The genus Columnaria, as given in treatises, comprises, besides the species here included, some that have the internal structure of the Cyathophylla, an error which has arisen from allowing too much importance to mere aggregation and external form. The character of the axis in some species is noticed by Fleming, Parkinson, Blainville, and others. The *Lithostrotion* of Llwyd is synonymous with the Columnaria of authors. The name is of prior date, but, besides its imperfect application—meaning a *stone pavement*—it was given previous to the Linnæan period without reference to system, and is therefore not entitled to authority.

Goldfuss, *Petref.*, 71, pl. 24; Blainville, *Man.*, 350; Llwyd, *Lithophyllacii Britannici Iconographia*, Epist. v, tab. 23, Lithostrotion. Also Fleming's *Brit. Animals*, 508, and Parkinson's *Organic Remains*, ii, pl. 5, figs. 3 and 6.

Genus 11. Sarcinula, *Lamarck*. Cespitose or fasciculate Cyathophyllidæ; stems cylindrical. Corallum having the cells multiradiate; internal septa oblique upward, and extending quite from the sides; axis distinct.

The internal texture in this genus, as seen in a transverse section, is quite open, without dissepiments, excepting the oblique septa which occupy the whole interior, and appear like a series of inverted cones traversed by a central axis, (see annexed figure.) The species are closely related to the Columnariæ; the principal difference consists in the extension of the septa quite across the interior to the sides, and the consequent absence of the exterior cellular texture; the septa moreover are more regular, and sometimes seem to constitute each a simple plate. The species have some

Fig. 5.



resemblance to the Stylinæ and Caryophylliæ, but differ in internal structure.

This genus was instituted by Lamarck for a few unlike species, characterized by consisting of parallel stems or tubes, and has been retained in treatises with the same indefinite characteristics. The Madrepora organum of Linnæus is best determined, and appears entitled to rank as the type of the genus, and has been so considered in this place. The characters have been drawn from the figures by Fougt and Schweigger, and from a specimen examined by the author. Other cylindrical fossil species, similar in external habit, belong to the genera Amplexus, Cyathophyllum, or some one of the preceding groups.

Fougt, *Amæn. Acad.*, i, tab. 4, fig. 6, and No. 1; Schweigger, *Beobacht.*, pl. 7, fig. 66, and *Handb.*, 419; Lamarck, 2d ed., ii, 340; Blainville, *Man.*, 348; Goldfuss, *Petrefakten*, tab. 74.

ART. IV.—*On the Chemical Composition of the Calcareous Corals;* by B. SILLIMAN, JR.*

THIS article is from the work on Zoophytes, by J. D. DANA,† for which the researches were undertaken. This volume is just out of press, but can hardly be said to have been *published*, since the small number of copies printed (only *two hundred*) will enable very few even of those most interested ever to see the work. The investigations have led to some unexpected results, which will be found to have an important bearing on the subject of geology; especially as serving to explain in a more rational way than any heretofore offered, the origin of those rarer ingredients in metamorphic limestones and other rocks of animal derivation; which have always been a puzzle to geologists.

No extended researches on the chemical constitution of corals have been made, it is believed, since Mr. Hatchett's, already cited by Mr. Dana. This chemist did not operate *quantitatively* on any of the species examined by him; and his investigations tended to show that the calcareous corals, as well as the coverings of most of the molluscs experimented upon, consisted merely of carbonate of lime. Such was the opinion with which these chemical examinations were commenced. But while they have found carbonate of lime to be the principal ingredient, other elements have been detected, showing that coral is far from being the simple calcareous material supposed.

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* In Vol. XLVII, p. 135, of this Journal, some earlier results obtained by me on this subject were stated, which were prematurely published, and greatly erroneous. The best antidote to an error of this sort is the early publication of correct and trustworthy results. It is to be hoped that the researches detailed in this paper are of this description, and the attention of those interested in such studies is invited to the repetition of the analyses here given. The geological interest of these observations is not in any way lessened by the results recently obtained, although differing so much from those previously published.—S.

† See *ante*, page 178, for the title, &c.

The following is a list of the species examined, which are here numbered for the convenience of reference:

1. Porites favosa, Sandwich Islands.
2. P. nigrescens, Feejees.
3. P. limosa, Feejees.
4. P. cylindrica, Feejees.
5. P. fragosa, Feejees.
6. Porites,* Paumotu.
7. Porites,* Wakes Island.
8. Porites,* Wakes Island.
9. Madrepora palmata, West Indies.
10. M. spicifera, Ceylon.
11. M. prolifera, Bermuda.
12. M. plantaginea, Ceylon.
13. M. cytherea, Tahiti.
14. Madrepora, Feejees.
15. Madrepora, Feejees.
16. Madrepora, Feejees.
17. Madrepora, Feejees.
18. M. cyclopea, Wakes Island.
19. Pocillopora damicornis, Sooloo.
20. P. elongata, Ceylon.
21. P. grandis, Feejees.
22. P. ligulata, Sandwich Islands.
23. P. cespitosa, Sandwich Islands.
24. Millepora tortuosa, Feejees.
25. Heliopora cærulea, East Indies.
26. Gemmipora brassica, Feejees.
27. Dendrophyllia nigrescens, Feejees.
28. Meandrina phrygia, Ceylon.
29. Astræa orion, Ceylon.
30. Astræa, (p. 721, pl. 13, fig. 15.)†
31. Astræa, Wakes Island.
32. Astræa, Wakes Island.
33. Astræa, Feejees.
34. Astræa, Feejees.
35. Astræa, Feejees.
36. Shell of Chama.

Nine of the above species, of which there was the largest quantity on hand, were selected for a minute determination of each ingredient, while of the others, only the proportion of carbonate of lime and animal matter to the other ingredients, was determined. The following are the nine selected:

I. Porites favosa (No. 1), Sandwich Islands.
II. Madrepora palmata (No. 9), West Indies.
III. Madrepora spicifera (No. 10), Ceylon.
IV. Madrepora prolifera (No. 11), Bermudas.
V. Madrepora plantaginea (No. 12), Ceylon.
VI. Pocillopora ligulata (No. 22), Sandwich Islands.
VII. Meandrina phrygia (No. 28), Ceylon.
VIII. Astræa orion (No. 29), Ceylon.
IX. Astræa (No. 30, p. 721, pl. 13, fig. 15.)

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* Worn specimens, not identified.

† The references are to Mr. Dana's work.

A few remarks are added upon some of their physical characters, before giving the mode and results of analysis.

Hardness.—All the various corals examined were superior in hardness to calcareous spar or common marble, and not inferior to Arragonite; while some were as hard as apatite or crystallized phosphate of lime; or according to the scale used by mineralogists, the usual hardness will be expressed by 4, though occasionally as high as 5. Using an iron mortar in the earliest trials, the iron pestle was roughened and cut under the resistance of the angular masses of coral, to a degree quite remarkable considering the nature of the substance operated on. So much iron was communicated to the powder from this source, that recourse was had to a mortar of porcelain, and even this was not proof against wear, the porcelain pestle being pitted by the repeated blows. The more porous species were crushed of course with less difficulty; and this was especially the case with the species of Porites.*

Specific gravity.—The specimens were reduced to fine powder before trying the specific gravity, as the porous character of the coral would otherwise interfere with obtaining correct results. Considerable variation will be observed in the following table. The numbers correspond to the catalogue on page 190.

Specimens.	Sp. Grav.	Specimens.	Sp. Grav.	Specimens.	Sp. Grav.
No. 1	2·817	No. 20	2·217	No. 31	2·688
3	2·732	22	2·564	33	2·500
4	2·564	23	2·353	34	2·500
9	2·421	25	2·578	Meand. rustica,	2·571
10	2·105	26	2·584		
12	2·427	27	2·740	Shell of Chama,	2·857

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* On this subject Mr. Dana remarks, p. 711:—"The hardness of these coral secretions, which is much above that of common carbonate of lime, as stated by Mr. Silliman, is not fully explained by the peculiar chemical composition detected by this chemist. We suggest, as one cause, that the calcareous portion may have, in its intimate texture, the structure of Arragonite, or prismatic carbonate of lime, instead of that of common rhombohedral calc spar. The Arragonite structure has been shown to be due to crystallization at a higher temperature than that which is required for calc spar, the two minerals being identical in composition: in consequence of this higher temperature, a different crystalline form is assumed; and, moreover, the material has a higher degree of hardness, that of Arragonite being designated by 3½ to 4, while common calc spar or rhombohedral carbonate of lime is 3. These remarks, it will be perceived, bear upon the internal calcareous secretions of other animals. In connexion, it should be observed, however, that distinct rhombohedrons of *calc spar* have been detected by Mr. Carpenter in the shells of some Molluscs."

The average from the sixteen species of corals is 2·523.

Color.—In general the color of the specimens examined was white, or nearly so; but some of them, as the Dendrophyllia nigrescens, and blue Heliopora (H. cerulea) were highly colored. The coloring matter, in all cases, proved to be organic, and was usually due to some trace of the animal tissues. The highly colored ones, when powdered, burnt white, giving out, at a red heat, the odor of animal matter. The Heliopora dissolved in chlorohydric acid, without having its color altered, and gave a light indigo-blue solution. A drop of nitric acid, however, discharged this color, and ammonia threw it down as a brown precipitate. Heat immediately destroys it. It is, therefore, evident that the coloring matter is entirely organic, and is in no way connected with the mineral constitution of the coral. However, some corals have a slight ferruginous tint, from the presence of a little peroxyd of iron, which will be seen to be an almost constant constituent, although in exceedingly small quantity.

Behavior with reagents.—All corals are rapidly dissolved in dilute chlorohydric, nitric, or acetic acids, with brisk effervescence and escape of carbonic acid. The solution is frequently colored by organic matter, which sometimes renders it turbid. When the powdered coral is treated with pure water, more or less of common salt and other soluble saline matters, derived from the evaporation of sea water, are washed out, and this precaution was found necessary to insure accurate results.

The solution of a coral in nitric acid is very soon blackened by a solution of *nitrate of silver*, from the presence of organic matter. Ammonia, added to a solution in nitric or chlorohydric acid, with the least possible excess of acid, will generally produce an immediate precipitate of granular ammonio-phosphate of magnesia, thus indicating the presence of both magnesia and phosphoric acid.

Chloride of barium produces, with a chlorohydric solution, a granular, white precipitate, which is nearly all redissolved in an excess of chlorohydric acid. (A small portion of sulphate of barytes is generally formed in using this test, owing to the almost constant presence of a small quantity of sulphate of lime in the corals.)

A portion, dissolved in nitric acid, and carefully neutralized, when treated with nitrate of silver, will, on standing, deposit a considerable yellowish precipitate of phosphate of silver, which is redissolved in ammonia and nitric acid.

Acetate of lead, added to a chlorohydric solution, produces a copious precipitate of chloride of lead, which is not wholly redissolved by an excess of acetic acid, but is taken up by nitric acid. These facts are a sufficient proof of the presence of phosphoric acid.

Lime-water, added to a solution of coral, either neutral or slightly acid, will produce an immediate gelatinous precipitate of all the bases and acids which the coral can contain, except, of course, the lime and solvent acid. Great care is needed in this operation to prevent the formation of a carbonate of lime; the solution should have been recently boiled, and the test applied while it is yet hot, the air being excluded; and the precipitate should be immediately collected on a filter and washed. If the precipitate by lime-water be fused in a platinum capsule, with carbonate of soda, or carbonate of potassa in excess, the phosphoric acid is all transferred to an equivalent portion of alkaline base, while the lime or magnesia, or the base with which it was before united, will remain as a carbonate. The usual tests, which have already been enumerated, will show the presence of the phosphoric acid.

The *lime-water* test offers far the best means of separating from the lime (which exists as a carbonate) all the other constituents of a coral, as these various substances are in very small quantity compared with the entire mass of the coral. Some easy means of completely separating them all, is an indispensable preliminary step in their examination and estimation.

I am indebted to my friend Dr. J. L. Smith, of Charleston, South Carolina, for suggesting to me the use of this test in the analysis of the corals.

As the several elements whose presence our researches have determined in corals, have been enumerated in the body of the work (p. 57), it is not necessary to repeat them here; but we may state, in a summary manner, an outline of the general course of analysis pursued in determining the constitution of the *lime-water precipitate*, which it will be allowed contains several elements whose association has always been considered as offering some of the most difficult problems in the whole range of inorganic analysis. The following plan of analysis has been contrived in part from the late researches of von Rammelsberg, on the estimation of phosphoric acid, and partly from the labors of Rose and Berzelius, adapting the method to the requirements of the particular problem before us.

A. The lime-water precipitate, after ignition, is weighed and then digested in fine powder in cold chlorohydric acid; it slowly dissolves, leaving a white flocculent powder. This collected and washed, will be found to be *silica*. It is harsh and gritty between the teeth, is not taken up by long digestion in strong acids, dissolves in a solution of caustic potassa, and before the blowpipe forms a hard colorless glass with carbonate of soda, dissolving in this reagent with effervescence.

B. The solution in chlorohydric acid is supersaturated with caustic ammonia, and boiled; a gelatinous precipitate separates, which is usually colored by iron, and by its characters indicates the presence of alumina. This precipitate contains the phosphoric and other acids, and the bases therewith combined. It is collected, and the filtrate therefrom (C) is examined for *lime* and *magnesia*, both of which are usually present.

D. The precipitate by ammonia (B) is next made into a thick paste with strong sulphuric acid, in a small vessel of platina. A plate of glass coated with wax and written on, is placed over the crucible; and heat being applied, *hydrofluoric acid* escapes, and attacking the glass, leaves a permanent record of its presence. I have never failed to obtain evidence of the presence of fluorine in any coral which has been subjected to the test. Generally, exposure for one minute will etch the glass most decidedly; and one experiment will suffice to mark distinctly several pieces of glass. By this plan of analysis the quantity of fluorine cannot be estimated, and it must be judged of either by the loss or by the deficiency of acids to satisfy all the bases formed. The constant association of phosphoric acid and fluorine, renders it advisable, in compounds in nature, where one of these elements is found, to search for the other.

E. After the sulphuric acid has been digested on (D) long enough to convert all the bases present into sulphates, a portion of bisulphate of potash or caustic potash is added, and a little water, to dissolve it; to this, a very large quantity of alcohol, of a specific gravity of about ·860, is added, and the whole is allowed to stand for some hours; during which the double sulphates of potassa, alumina and iron, crystallize out, while any lime previously combined is separated as sulphate; and in the solution we must look for the phosphoric acid and magnesia, together with a little persalt of iron, held up by the alcohol.

F. The mixture (E) being filtered, and the precipitate washed quite clean with alcohol, the filtrate is evaporated until all the alcohol is expelled, and then supersaturated with ammonia; a little trace of alumina and iron separates, which may be added to that to be obtained from the other portion (H). We may now either add an excess of pure chloride of calcium to the filtrate (F), or a portion of perchloride of iron. The object in either case is to separate the phosphoric acid in combination with a base, from whose weight its quantity may be directly estimated, which is an indispensable step, since the fluorine, according to this plan of analysis, can be estimated only by the amount required to saturate the excess of bases. In case the chloride of calcium is employed, we have all the phosphoric acid in the form of phosphate of lime, mixed with a large quantity of sulphate of lime, derived from the sulphuric acid and sulphate of potassa previously employed. This mixture of phosphate and sulphate of lime is collected, washed, and redissolved in chlorohydric acid. The sulphate of lime is separated by alcohol, and the phosphoric acid remains in solution, which, after the excess of alcohol has been expelled, may be thrown down by ammonia, ignited and weighed, or preferably, may be estimated by a magnesian salt. If we employ the method by perchloride of iron, we form in the acid solution containing the phosphoric acid, a basic perphosphate of iron, on supersaturating the solution with ammonia. This compound is mixed with a bulky mass of peroxide of iron, which being thrown on a filter and thoroughly washed, is subsequently decomposed completely by hydrosulphuret of ammonia, into sulphuret of iron and phosphate of ammonia. Care must be taken to use a sufficient quantity of perchloride of iron, otherwise a white precipitate of neutral perphosphate of iron is formed, which is soluble in an excess of ammonia. In either case (the employment of the chloride of calcium, or the perchloride of iron) the phosphoric acid eliminated may be finally best estimated by a magnesian salt and ammonia, as the ammonio-phosphate of magnesia, from whose known constitution the phosphoric acid is easily calculated. We have employed both of these methods; but on many accounts prefer that by the perchloride of iron.

G. The alcoholic filtrate from (F), containing magnesia and lime, is treated by the well known methods of analysis for the estimation of those substances. The lime in all cases in these researches, was converted into sulphate and precipitated by alcohol. The magnesia was estimated as phosphate.

H. The crystalline precipitate from (F), which was collected on the filter, contained the alumina and iron, previously in combination with phosphoric acid or fluorine. This precipitate is boiled in a capsule with a strong solution of carbonate of soda, to decompose the sulphate of lime; it is then filtered, the insoluble residue washed thoroughly and treated with chlorohydric acid, the precipitate by ammonia from (F) being added, and the whole treated with excess of ammonia. Alumina and iron fall, which may be afterward separated in the usual way; but this was generally not deemed requisite, the quantity of iron being very small in most cases.

I. The filtrate from (H) is treated for lime by oxalate of ammonia, and the oxalate converted into sulphate and weighed: this dose of lime had been previously united to phosphoric acid or fluorine.

J. Magnesia is next separated from the filtrate of (I), by ammonia and phosphate of soda.

K. The alkaline liquor from (H) contains another portion of magnesia, which is separated in like manner as the ammonio-phosphate. Much labor is saved if we take care to reserve the several portions, from which magnesia has been thrown down, and unite them in one filtration and weighing, instead of treating them as so many separate portions.

The minute determination of all the constituents of the lime-water precipitate, was attempted only on those specimens of which we had a large quantity at command; for a solution of half a pound or more of the coral in nitric or chlorohydric acid, was necessary to afford sufficient precipitate for analysis. The carbonate of lime, by far the most abundant constituent, was separately determined on one gramme, as sulphate of lime, and from this the carbonate was calculated. The ratio of phosphates and fluorides of the several bases to the entire mass was also determined from a distinct portion of coral, two grammes by weight; and from the data thus furnished, we have the means of safely estimating the organic matter by the loss.

Organic matter.—This constituent of the corals deserves particular notice. Some remarks have already been made on it, when speaking of the coloring matter of corals. This organic matter is so intimately united throughout the whole structure of the corals, amounting to 4 to 8 per cent., that it cannot be separated by any method resorted to, except by repeated deflagrations with the nitrate of ammonia. When reduced to the finest impalpable powder, it may be digested in repeated doses of boiling water, until no trace of organic matter is longer found in the water; and yet a careful analysis, by falling short of the amount required to complete the 100 parts, will invariably show its presence. The oxalate of lime obtained in their analysis, if ignited, (as in the usual manner directed for the estimation of lime,) will always have a dark carbonaceous hue, derived from the organic matter of the coral.

During the solution of considerable quantities of several corals, whose analyses are given beyond, (particularly in No. IV, but more or less in all,) a large quantity of fatty (?) matter separated, of a yellow color and disagreeable penetrating odor, though not fetid. It was easily seen floating on the surface of the solution, in transparent jelly-like masses of a yellowish color. It was insoluble in alcohol, but readily so in cold ether, and the evaporation of its ethereal solution yielded a yellow solid, resembling wax. It fuses below 200° F. A pungent irritating odor arose from the evaporation of the ethereal solution near its close, which acted powerfully on the eyes and nostrils. This volatile principle may be analogous to that known to proceed from the decomposition of fat, (acrolein?) It deserves more attention than I have been able to give it, particularly as it may perhaps be the source of the disagreeable odor of some limestones of coral origin.

Analyses.—The following tables exhibit a comprehensive view of the results of the several analyses. The relative proportions of organic matter, carbonate of lime, and the complex precipitate of phosphates and fluorides thrown down by lime-water, are first given; and afterwards the definite composition of this precipitate in the nine species more minutely investigated.

	Porites. No. 1 (I).	Porites. No. 3.	Porites. No. 4.	Porites. No. 5.	Porites. No. 6.
Carbonate of lime,	95·84	94·412	94·807	93·875	89·864
Phosphates and fluorides,	2·05	0·900	0·950	1·561	0.700
Organic matter,	2·11	4·688	4·243	4·564	9·431

	Porites. No. 7.	Porites. No. 8.	Madrepora. No. 9 (II).	Madrepora. No. 10 (III).	Madrepora. No. 11 (IV).
Carbonate of lime,	94·438	95·000	94·807	92·815	95·086
Phosphates and fluorides,	2·100	1·650	0·745	0·600	0·300
Organic matter,	3·462	3·350	4·448	6·585	4·614

	Madrepora. No. 12 (V).	Madrepora. No. 14.	Madrepora. No. 15.	Madrepora. No. 16.	Madrepora. No. 17.
Carbonate of lime,	94·881	93·297	94·143	94·239	93·59
Phosphates and fluorides,	0·710	2·450	0·900	0·500	0·50
Organic matter,	4·409	4·253	4·957	5·261	5·91

	Pocillopora. No. 19.	Pocillopora. No. 20.	Pocillopora. No. 21.	Pocillopora. No. 22 (VI).	Pocillopora. No. 23.
Carbonate of lime,	94·659	93·60	95·001	93·848	94·583
Phosphates and fluorides,	0·550	1·90	1·450	0·550	1·050
Organic matter,	4·791	4·50	3·549	5·602	4·397

	Millepora. No. 24.	Heliopora. No. 25.	Gemmipora. No. 26.	Meandrina. No. 28 (VII).	Astræa. No. 29 (VIII).
Carbonate of lime,	94·226	95·545	92·751	93·559	96·471
Phosphates and fluorides,	1·200	1·000	1·500	0·910	0·802
Organic matter,	4·574	3·455	5·749	5·536	2·727

	Astræa. No. 30 (IX).	Astræa. No. 31.	Astræa. No. 33.	Astræa. No. 34.	Astræa. No. 35.
Carbonate of lime,	96·551	94·810	91·782	93·923	91·112
Phosphates and fluorides,	0·262	0·900	2·100	0·500	0·550
Organic matter,	3·187	4·290	6·118	5·577	8·338

A portion of the massive shell of a large Chama, treated in a similar manner, afforded for 100 parts the following result:

Carbonate of lime, . .	97·007
Precipitate by lime-water, . .	2·600
Organic matter, . . .	0·398

The amount of organic matter is here very small; while the precipitate by lime-water is large. The examination of other shells with reference to this point, would have been highly interesting, and had it fallen within the scope of these researches, the subject would have been farther investigated.

The per-centage of phosphates and fluorides in the above analyses, after excluding the organic matter, is as follows:

Specimens.	Phosphates and Fluorides.	Specimens.	Phosphates and Fluorides.	Specimens.	Phosphates and Fluorides.
No. 1 (I.)	2·095	No. 12 (V.)	0·743	No. 24	1·258
3	0·945	14	2·562	25	1·036
4	0·992	15	0·947	26	1·593
5	1·637	16	0·528	28 (VII.)	0·964
6	0·774	17	0·537	29 (VIII.)	0·825
7	2·177	19	0·578	30 (IX.)	0·270
8	1·710	20	1·990	31	1·040
9 (II.)	0·780	21	1·504	33	2·114
10 (III.)	0·642	22 (VI.)	0·583	34	0·529
11 (IV.)	0·314	23	1·099	35	0·600

It now remains to give the constitution of the precipitate of fluorides and phosphates. The results annexed are calculated for a hundred parts of the precipitate.

	I.	II.	III.	IV.	V.
Silica,	22·00	12·5	13·50	10·32	23·74
Lime,	13·03	7·5	10·40	15·57	35·01
Magnesia,	7·66	4·2	1·63	38·49	1·35
Fluoride of calcium,	7·83	26·34	34·85	7·50	8·88
Fluoride of magnesium,	12·48	26·62	19·06	2·62	20·44
Phosphate of magnesia,	2·70	8·00	5·87	0·25	3·46
Alumina (and iron),	16·00	14·84	14·69	25·25	7·12
Oxide of iron,	18·30				

	VI.	VII.	VIII.	IX.
Silica,	5·35	11·0	30·01	8·70
Lime,	7·17	25·9	17·45	16·74
Magnesia,	0·49	0·8	24·57	45·19
Fluoride of calcium,	4·05	15·0	0·85	0·71
Fluoride of magnesium,	Phosphate of lime, 4·25	Fluoride of mag. 23·2	4·31	2·34
Phosphate of magnesia,	16·30	4·7	0·32	0·34
Alumina (and iron),	35·00	19·4	22·49	25·97
Oxide of iron,	27·39			

The foregoing results show that, contrary to the expectation when the research was commenced, the fluorine is present in much larger proportion than phosphoric acid. The silica exists in the coral in its soluble modification, and probably is united to the lime. The free magnesia existed as carbonate, and was thrown down as caustic magnesia by the lime-water. Some small portion of lime was probably thrown down as carbonate, in spite of every precaution to the contrary. Only in two or three instances, however, was there any effervescence on the addition of chlorohydric acid to redissolve it.

It need hardly be said that the existence in sea water of all the matters noted in these analyses, is a just inference; but this subject, as well as the important geological inferences which may be drawn from the results now presented, will be fully discussed on another occasion.

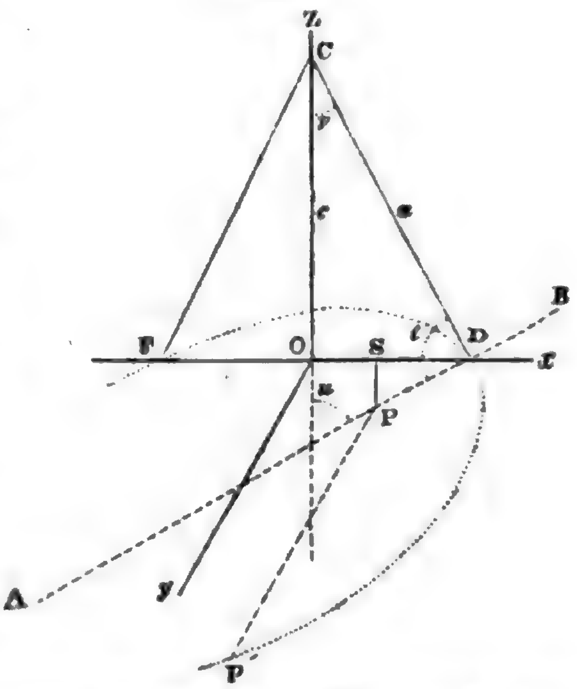
My warmest acknowledgments are due to my friends and pupils, Messrs. D. Olmsted, Jr. and T. S. Hunt, who have zealously aided me in the laborious parts of these investigations.

Yale College Laboratory, December 16th, 1845.

ART. V.—*Foci of Parabolas;* by GEORGE WATERMAN, Jr., A. M., Professor of Mathematics in Miami University.*

The foci of all parabolas cut from a given cone by planes parallel to the same element, are in a right line passing through the vertex of the cone.

Fig. 1.



Let v, (fig. 1,) represent the angle OCD formed by any element of the cone with its axis: assume the axis of z as the axis of the cone; and let O be the origin of a system of rectangular coördinates. Representing the distance OC by c, the general equation of the conic surface will be of the form, $x^2+y^2=(z-c)^2 . \text{tang.}^2 v$.

If the cone be intersected by a plane AB, perpendicular to the plane zx, and making an acute angle with the axis z, it will cut out a curve, whose properties will vary with the relative position of the plane and axis.

Assume the point D, as the origin of a new system of coördinates, and represent these coördinates by x', y' and z'. Then for any point on the curve, as P′, we shall have $P'P=y'=y$. $PD=x'$. $PS=-z$. Represent the angle which the cutting plane AB makes with the axis of z, by u; the angle which the same plane makes with the extreme element CD by i; and the distance CD by a. We shall then have $OD=a\sin v$. $DS=x'\sin u$. $PS=-z=x'\cos u$. $OS=x=OD-DS=a\sin v-x'\sin u$; and $c=a\cos v$; or $x=a\sin v-x'\sin u$. $y=y'$, and $z=-x'\cos u$. Substituting these values in the general equation of the conic surface above, and reducing, we obtain for the intersection, $y'^2\cos v-2ax'\sin v\cos v\sin(u+v)+x'^2\sin(u+v)\sin(u-v)=0$. But since $i+u+v=180°$, $u+v=180-i$, and $u-v=180-(i+2v)$. Hence

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* Since the following communication was received, Prof. W. has accepted the appointment to the chair of Natural Philosophy and Astronomy in the Newton University, Baltimore; and ere this has probably entered upon its duties.

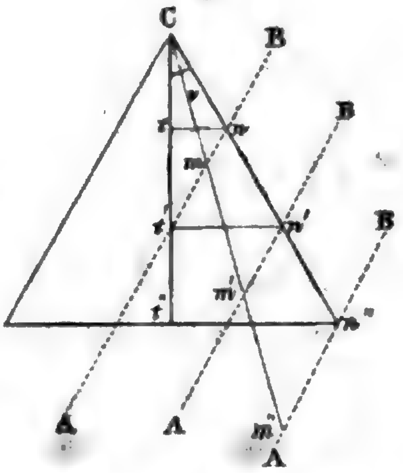
$\sin(u+v)=\sin i$, and $\sin(u-v)=\sin(i+2v)$. Substituting these values, and we find for the general equation of intersection,

$$y'^2\cos^2 v-2ax'\sin v\cos v\sin i+x'^2\sin i\sin(i+2v)=0.$$

If we make $i+v=180°-v$, or $i+2v=180°$, the plane AB will become parallel to the extreme element of the cone CF. Under this supposition $\sin i + \sin 2v$, and $\sin(i+2v)=0$. Introducing these values, and the equation of intersection becomes $y'^2\cos^2 v - 2ax'\sin v\cos v\sin 2v=0$. But $\sin 2v=2\sin v\cos v$: hence $y'^2\cos^2 v - 4ax'\sin^2 v\cos^2 v = 0$; or $y'^2 - 4ax'\sin^2 v = 0$; or finally, $y'^2 = 4ax'\sin^2 v$. But $a\sin v=\text{OD}$. Representing this by r, we have $y'^2=4r\sin v.x'$, or, omitting the accents of the variables, $y^2=4r\sin v.x$, which is the equation of the common parabola. In this equation, $4r\sin v$ is the parameter, and $r\sin v$ the distance from the vertex of the curve to the focus, which may be represented by $\frac{p}{2}$. Since v, and consequently the sine of v, is constant for the same cone, we may represent it by b. We shall then have $y^2=4brx$. But since b is constant for the same cone, the distance from the vertex to the focus will vary with r.

Making $r=0$, we find $\frac{p}{2}=0$.
" $r=1$, " " $\frac{p}{2}=b$.
" $r=2$, " " $\frac{p}{2}=2b$.
&c. &c.

Fig. 2.



If mn (fig. 2,) be made equal to $b=\sin v$, we shall have from similar triangles, $Cn : tn :: Cn' : t'n' :: Cn'' : t''n''$, &c.; and $Cn : mn :: Cn' : m'n' :: Cn'' : m''n''$, &c. Hence, $tn : mn :: t'n' : m'n' :: t''n'' : m''n''$, &c. But mn is the distance from the vertex to the focus of that parabola cut from the cone at the point where $tn=r=1$. If the spaces Cn, nn', $n'n''$, &c. be made equal, we shall have for $t'n'=2tn$, $m'n'=2mn$, $m''n''=3mn$, &c. But when $tn=r$ is equal to zero, we have seen that $\frac{P}{2}=0$. Hence,

1st. When $r=0$, $\frac{P}{2}=0$, *or the focus is at the vertex of the cone.*

2d. *The line drawn through the vertex of the cone and the focus of any one parabola, will pass through the foci of all others cut from the same cone by planes parallel to the same element.*

If the line Cm'' be revolved around the axis of the cone, it will generate the surface of a new cone, which surface will be the locus of the foci of all the parabolas which can be cut from the given cone by planes parallel to *any* element.

Miami University, Oxford, (Ohio,) March 7, 1845.

ART. VI.—*Abstract of a Meteorological Journal, for the year* 1845, *kept at Marietta, Ohio*, Lat. 39° 25′ N., Lon. 4° 28′ W. of Washington City; by S. P. HILDRETH, M. D.

MONTHS.	THERMOMETER.							BAROMETER.		
	Mean temperature.	Maximum.	Minimum.	Fair days.	Cloudy days.	Rain and melted snow, in inches.	Prevailing winds.	Maximum.	Minimum.	Range.
January, - -	37·10	58	22	10	21	2·58	S. W., N. W.	29·83	29·10	·73
February, -	38·33	70	8	18	10	1·50	W., N. W.	29·75	29·05	·70
March, - -	43·50	77	18	17	14	2·67	N. W., N.	29·80	29·08	·72
April, - -	58·47	89	15	23	7	2.50	W., N. W., N.	29·70	29·35	·35
May, - -	59·70	85	30	26	5	1·33	N., N. W., S. W.	29·70	29·38	·32
June, - -	69·74	90	44	17	13	6·55	S. W., S. E.	29·65	29·28	·37
July, - -	72·57	90	49	22	9	3·22	S. W., N., N. W.	29·55	29·20	·35
August, - -	71·17	90	52	23	8	2·00	S. W., S.	29·65	29·25	·40
September, -	63·90	84	40	21	9	4·38	S. W., N.	29·60	29·25	·35
October, - -	50·74	76	23	25	6	2·80	S. W., N.	29·96	29·25	·71
November, -	42·10	73	18	17	13	3·04	S. W., W., N. W.	29·80	29·12	·68
December, -	25·40	45	–2	17	14	1·33	W., N. W., N.	29·72	29·18	·54
Mean,	52·73			236	129	33·90				

Remarks on the year 1845.—The year which has just closed will long be remembered in the annals of Ohio, for the cold drying winds and late frosts which attended the spring months, and the excessive drouth of the summer; especially over the central and northern portions of the State. At Marietta, from the 10th of March to the 22d of April, there fell less than two-twelfths of an inch of rain; while the cold drying winds from the west and the northwest, served to evaporate, with great rapidity, the moisture which usually saturates the earth from the rains of the latter part of winter and early spring. The effect of these cold drying winds on the meadows and pastures was very injurious, checking the growth of the grasses and shrivelling their roots, so that by the middle of May, there was little more appearance of vegetation than there usually is in the last of March. Farmers who had hay, fed their cattle the same as they do in winter; and the earth was not fairly soaked with rain until the middle of June. Repeated frosts continued to follow each other until the first of that month, cutting down and destroying the corn, potatoes and beans, three or four times in succession; so that most fields needed to be replanted and replowed two or three times, making it as late as the 5th of June when the last replanting took place. Early planted potatoes were nearly all ruined, yielding a crop but little larger in amount than the seed used. Wheat suffered excessively from the drouth and frosts. On the 9th of April, the mercury fell to 15° Fahr.; killing many fields of wheat, which the warmth of March had hurried forward in its growth earlier than usual. About the middle of June, the prospect for crops was very gloomy, and there was much fear that we should have a greater scarcity of food, both for man and beast, than was ever seen in Ohio. After that time, abundant rains set in through the southern portions of the State, and the wheat and corn revived in a wonderful manner; the former yielding a medium crop and the latter a pretty fair one. The meadows were too much exhausted by the drouth to recover their fertility, and the growth of hay was a great failure, yielding less than half the amount of usual years, and that of a very poor quality. The price of hay, which is commonly five or six dollars a ton, rose to ten or eleven in the farming districts, and to fifteen and eighteen in the cities. In addition to the other calamities of the season, the disease called "*the rot*," appeared among the potatoes, and destroyed large quantities of this valuable vegetable. What may be the ultimate result of this new scourge remains to be seen. It may continue to spread and increase in malignity, or more favorable seasons may put a check to it entirely. The late spring frosts were more destructive to the fruits than to the grain and grasses. Apples, pears, peaches, plums and cherries were an entire failure, except in a few favored spots, from Wheeling to Cincinnati, along the river and extending back to the vicinity of Lake Erie. Grapes, gooseberries and strawberries suffered in the same way, about Marietta. The first were all killed, except where protected by the warmth of a building, from the frosts in May. The season was very similar in this respect to that of the year 1834.

The mean temperature of the year 1845 was 52·73°, which is about the average for a series of years. The Author of nature has so arranged the seasons that the amount of heat in any one year does not materially differ from that of another, although to a careless observer it may seem not to be so. It is oftentimes distributed in a different manner; one spring being warmer than another, and one summer much cooler, thus causing an exceeding great variety in the seasons, all for wise and beneficent purposes. Yet amidst all this diversity, the wisdom of God is displayed in the exceeding regularity and certainty of the laws which govern the temperature of the year, not only in the same, but in different climates. "Summer and winter, seed-time and harvest," we are assured, shall regularly return so long as the earth continueth.

The amount of rain and melted snow was 33·90 inches, being about 6 inches less than the mean annual average for this climate. Here also the same beautiful laws which regulate the heat, govern the quantity of rain which is needed to supply the necessities of plants and animals, being nicely adapted to the moderate or rapid manner in which it is evaporated by the heat of the climate. In the cold regions of the north, a few inches supply all the wants of the vegetable kingdom; while in the tropics, it is poured down in torrents, amounting in some places to twelve or fourteen feet annually. Who but an atheist could fail, in this law, to see the guiding and directing hand of the great Architect of the Heavens.

Winter.—The mean temperature of the winter months was 36·60°, which is more than two degrees warmer than in 1844. The mercury was at no time down to zero; the coldest day being the 7th of February, when it fell to eight degrees above. The Ohio river was not frozen over, and steamboats continued to run all winter, with the exception of a few days about the 20th of December. No ice was formed of sufficient thickness for laying up in ice-houses, and only a scanty supply was procured from floating fragments in the Ohio, at the breaking up of the Allegheny, in February. The amount of snow was small, the greatest quantity at any one time being three inches, which was in December—it being remembered that in making up the temperature of a winter, this month is always attached to that of the following year, where it properly belongs.

Spring.—The mean temperature for the spring months was 53·89°, which is two degrees less than that of 1844, and nearly five less than that of 1842. The months of February and March were each nearly a degree warmer than those of 1844, and brought forth vegetation at a rapid rate, so that the garden crocus was in bloom by the 20th of the former month, and until the 20th of the latter, there was every prospect of an early and favorable spring, but after that time, the frequent frosts of April and May destroyed all the flattering prospects of the flower garden and orchard. The following floral calendar will show the progress of vegetation and the injuries which it sustained from the inclemency of the season.

Floral calendar.—February 11th, robin, Turdus migratorius, appears; 12th, blue-bird, Hirundo purpurea, seen; 20th, yellow crocus in bloom, honey bee at work; 24th, the earth is sufficiently dry and warm to plant onions, peas and potatoes.

March 5th, red elm and willow in bloom; 6th, Hepatica triloba in bloom; 10th, daffodil; 12th, apricot tree in bloom; 13th, early hyacinth; 19th, windy, with showers of snow; on the morning of the 22d, the mercury fell to 18°, which is several degrees lower than since the 7th of February; but there was frost nearly every morning from the 12th to the 29th of March; 29th, scarlet-colored Pyrus japonica in bloom; 30th, peach tree and crown imperial; 31st, streets dry and dusty—no rain for twenty one days.

April 2d, Italian narcissus in bloom; 3d, Sanguinaria canadensis; 5th, imperial gage; 6th, Mespilus arborea, June berry; 8th, cold wind—snow fell half an inch in the night—mercury at 22°; 9th, thermometer at 15° in the morning—all ended with a cold dry wind. Last night destroyed the blossoms and germs of nearly all the various kinds of fruit; also a vast many flowering buds of the tulip, which were just beginning to appear above the surface. Out of more than two thousand bulbs of this splendid flower, not more than sixty or eighty ever opened their petals. Several large plants of the Pæonia moutan, which is one of the most hardy of plants, suffered in the same way, although covered with mats; only one plant escaped, which was of the single variety, and was protected by being covered with a barrel. Peas three inches high were killed. 10th, on this day the great fire at Pittsburgh took place; 11th, Anemone virginiana; 12th, earth very dry—plants dwarfish and sickly; 16th, cherry in bloom, but the germ is black and dead; 18th, apple tree in bloom, germ brown; 19th, primrose and cowslip; 20th, Ranunculus acris; 21st, vernal snow-drop; 22d, Anona glabra, or papaw—the fruit all killed, except in one sheltered spot, a few miles below, on the Ohio river; 24th, Trillium thalictroides—also black haw; 26th, Cornus florida in bloom. The Cercis ohioensis, or red-bud, which opens its beautiful purple blossoms at the same time with the Cornus, and affords such a rich contrast of color, is this year barren, being killed by the cold of the 9th. It is one of our most common forest ornaments, and is greatly missed. 27th, Claytonia and columbine; 28th, pea in bloom, from shoots thrown up since the 9th; 30th, single Pæonia moutan.

May 1st, Cineraria canadensis—double yellow rose; 2d, rose colored peony, herbaceous; 3d, purple mulberry; 8th, hard frost this morning, killing beans, corn and grape blossoms; 9th, Boursault rose in bloom; 10th, Rubus villosus—the frost destroyed nearly all the fruit of this full berry, which is a rare occurrence—black walnut; 11th, Robinia pseudacacia, which is thirteen days later than last year; 14th, Kalmia latifolia—this shrub bears transplanting well when in blossom; 15th, Maclura aurantiaca; 17th, Prunus virginiana—hard frost this morning; 19th, Magnolia tripetala; 24th, strawberry ripe—peas fit for the table; 25th, Syringa philadelphica; 26th, hard frost; 27th, Privet in bloom; 30th and 31st, frost on both these mornings—Seneca locust in bloom.

June 1st, rose bugs appear in thousands, and are very destructive to the blossoms of grapes, a few of which on the sides of buildings escaped the frosts; 2d, hardy roses generally in bloom; 6th, drouth very severe—pastures, meadows and corn perishing; 11th, Catalpa tree in bloom. After the 10th of this month there was an abundance of rain, six and a half inches falling by the end of the month. The effect on plants and vegetation was surprising, reviving the perishing wheat and corn in a few days to vigorous growth. 14th, Sambucus canadensis; 17th, black raspberry ripe; 18th, cucumbers fit for the table, protected under boxes; 23d, red and white Antwerp raspberry ripe, such as escaped the frosts; 30th, wheat harvest begins in early sown fields. Indian corn has grown so rapidly in the last fifteen days, that it looks nearly as well as in ordinary years.

Some fields were replanted three times. This grain can be planted from the first of April to the first of June in this climate, and make a crop.

July 1st, whortleberry ripe, being protected from frosts by the forest trees, among which they grow; 10th, chestnut tree in bloom; 16th, hay harvest begins, some weeks later than usual, and the crop is poor and thin.

Summer.—The mean temperature of the summer months was 71·16°, which is a little higher than that of 1844, and was favorable in this part of Ohio to vegetation. In June and July, there fell nearly as much rain as in the five preceding months, and produced a rapid growth in Indian corn, potatoes and oats. The wheat crop was a tolerable one, and the grain generally ripened well. Nearly all our summer fruits were destroyed, such as strawberries, gooseberries, currants, peaches and grapes. Melons, of both varieties, planted after the first of June, produced fine crops, and partly compensated for the loss of the fruit. Apples and pears were very scarce, and what few there were generally proved defective and rotted soon. For winter use, there were very few orchards that produced any, which was a serious loss to many farmers near Marietta, who put up annually for market from five hundred to two thousand barrels, of the choicest varieties.

Autumn.—The mean temperature of the autumnal months was 52·25°. This season was very pleasant while it continued, but terminated rather abruptly the latter part of November; the last nine days were quite cold, and the ground was covered with snow on the 30th. December commenced with great severity; on the morning of the first day, the snow which fell on the last night of November, was nine inches deep; and the morning of the 2d, the mercury sunk to zero. The rivers were filled with floating ice, and on the 5th day of December, the Ohio was frozen over, and the navigation of boats remained obstructed into January, 1846. The thermometer has been below zero on several mornings, and the season is thus far the coldest we have had for several years.

A brief account of the drouth in the northern portion of Ohio, in the vicinity of Lake Erie.—The district of country which suffered the most, was about one hundred miles in length and fifty or sixty in width, extending nearly east and west parallel with the lake, and in some places directly bordering on the shore of this great inland sea. There was no rain from the last of March or the first of April, until the 10th of June, when there fell a little rain for one day, but no more until the 2d of July, when there probably fell half an inch, as it made the roads a little muddy. From this time, no more rain fell until early in September. This long continued drouth reduced the streams of water to mere rills, and many springs and wells heretofore unfailing became dry, or nearly so. The grass crop entirely failed, and through several counties the pasture grounds in places were so dry, that in walking across them the dust would rise under the feet, as in highways. So dry was the grass in meadows, that fires, when accidentally kindled, would run over them as over a stubble-field, and great caution was required to prevent damage from them. The crop of oats and corn was nearly destroyed. Many fields of wheat so perished that no attempt was made to harvest them. Scions set in the nursery, dried up for lack of sap in the stocks, and many of the forest trees withered, and all shed their leaves much earlier than usual. The health of the inhabitants was not materially affected, although much sickness was anticipated. Grasshoppers were multiplied exceedingly in many places, and destroyed every green thing that the drouth had spared, even to the thistles and elder tops by the roadside.

The late frosts and cold drying winds of the spring months, cut off nearly all the fruit, and what few apples remained, were defective at the core and decayed soon after being gathered in the fall. Many of the farmers sowed fields of turnips in August and September, hoping to raise winter food for their cattle, but the seed generally failed to vegetate for lack of moisture. So great was the scarcity of food for the domestic animals, that early in autumn large droves of cattle were sent into the valley of the Scioto, where the crops were more abundant, to pass the winter, while others were sent eastward into the borders of Pennsylvania. This region of country abounds in grasses, and one of the staple commodities is the produce of the dairy. Many stocks of dairy cows were broken up and dispersed, selling for only four or five dollars a head, as the cost of wintering would be more than their worth in the spring. Such great losses and suffering from the effects of drouth, has not been experienced in that portion of

Ohio for many years, if at all since the settlement of the country. As the lands become more completely cleared of the forest trees, dry summers will doubtless be more frequent. In a region so near a large body of water, we should expect more rain than in one at a distance. The sky in that district is, nevertheless, much oftener covered with clouds than in the southern portion of the State, where rains are more abundant; but the dividing ridge, or height of land between Lake Erie and the waters of the Ohio, lacks a range of high hills to attract the moisture from the clouds, and cause it to descend in showers of rain.

For the above account of the drouth in the "Western Reserve," I am under obligation to Seabury Ford, Esq., of Granger county.

Marietta, Ohio, January 8, 1846.

Art. VII.—*Observations on the Eocene formation of the United States, with descriptions of species of Shells, &c. occurring in it;* by T. A. Conrad,—(with two plates.)

Since I discovered the Eocene formation in Maryland in 1830, my own researches and those of others, have proved its wide extension in the southern and southwestern states, and I now propose to publish descriptions and illustrations of most of the organic remains of that formation in the pages of this Journal. The development of the Eocene is much greater than was supposed, in consequence of its embracing a white friable limestone, formerly referred to the upper cretaceous period. In reviewing the organic remains of that rock, I cannot resist the conviction that it is so nearly of the same age with the Eocene sands of Alabama, Mississippi, Louisiana, &c., that it may not with propriety be referred to an earlier era. The occurrence of what were supposed to be remains of Enaliosauri, now proved by Mr. Owen to be more of a cetaceous character; the genus Plagiostoma, Gryphæa vomer, (Morton,) and one or two other secondary forms, led me to believe that the limestone in question was a connecting link between the secondary and tertiary strata. But I now find the group of fossil genera to have so decided an affinity with that of the Eocene period, that I confidently class the whole white limestone of the southern parts of Alabama and Mississippi with the strata of that era. This limestone is extensively developed in Clarke Co., Alabama, where the remains of Zeuglodon were found and transmitted to me in 1834, by Mr. Cooper, of Claiborne. Six miles west of Claiborne I examined this rock in the banks of a mill-stream and collected Scutella Rogersii, Pecten Poulsoni, and P. perplanus, &c. Between Claiborne and St. Stephens it forms hills of considerable elevation, and abounds in that fine fossil, Plagiostoma dumosum. At St. Stephens, on the Tombeckbee, this limestone constitutes an elevated bluff and abounds in Nummulites Mantelli, Plagiostoma dumosum, Ostrea cretacea, &c. At Vicksburg, the Pecten Poulsoni is common to this rock and to the Eocene sand, and the Zeuglodon was found on the Washita river in similar sand, as is proved by portions of the matrix adhering to the bone, with fragments of well known Claiborne fossils, and a perfect valve of Corbula oniscus. This gigantic animal therefore lived in a period when the limestone and sand were both deposited, and which are probably of contemporaneous origin.

The following is a list of the fossils I obtained from the Eocene limestone of Alabama and Mississippi: Zeuglodon, Owen, (Basilosaurus, Harlan,) Pecten Poulsoni, P. perplanus, P. elixatus, P. anatipes, P. calvatus, Modiola cretacea, Plagiostoma dumosum, Gryphæa vomer, Ostrea cretacea, O. panda, Nummulites Mantelli, Scutella Rogersii. Of these species, Ostrea cretacea, O. panda, and Gryphæa vomer, occur also in the cretaceous strata of New Jersey and Alabama. The fossils of the Carolina and Alabama limestones are figured and described by Dr. Morton in his Synopsis of the Organic Remains of the Cretaceous Formations.

The following species occur both in the Eocene of Paris and of Claiborne, &c. They were published, with the exception of Fusus longævus, in 1835, in the Tert. Foss., p. 34. Solarium patulum, *Lamk.*, S. canaliculatum, *Lamk.*, Bonellia terebellata, Sigaretus canaliculatus, *Sow.*, Calyptræa trochiformis, *Lamk.*, Pyrula tricarinata, *Lamk.*, Corbis lamellosa, *Lamk.*, Cardita planicosta, *Lamk.*, Fusus longævus, *Lamk.*

The last named shell was found by Professor Rogers and identified by myself with the Paris species. To the foregoing list may be added *Trochus agglutinans*, and *Lithodomus dactylus*, found by Lyell, in Georgia.

EOCENE SHELLS.

SILIQUARIA.

The genus Siliquaria of Lamarck, is not of earlier origin than the Eocene period. The one species I have described is the only one hitherto discovered in this country, either recent or fossil. Chenu figures sixteen species, five of which are fossil in the tertiary strata of France. Deshayes enumerates five species in the Paris basin, (Eocene.)

SILIQUARIA VITIS. Irregularly contorted, rounded, longitudinally striated; the striæ disappearing on the lower part of the shell; volutions more regular and approximate towards the apex, and the longitudinal striæ prominent; fissure inarticulated. (Plate I, fig. 1.)

Siliquaria vitis, Con.; Foss. Shells of Tert. Form., p. 36, Aug. 1833.

S. claibornensis, Lea, Cont. to Geol., Plate I, fig. 1, Dec. 1833. Chenu, Plate II, fig. 15.

Claiborne, Alabama.

This species is not uncommon, but it can only be obtained in fragments; it is much contorted, and I have seen it in the bluff more than twelve inches long. The volutions resemble those of S. anguina, and the longitudinal lines upon them are rather coarse and slightly prominent.

DENTALIUM.

The genus Dentalium of Linnæus, has been observed in the Lias and great Oolite of England. In the United States it has not been found of older date than the Eocene period. Two species of that formation, and two of the Miocene, comprise all that have come under my observation. The Miocene, D. dentale, is identical with the recent shell which inhabits the coast of Massachusetts. I have not met with another recent species on the coasts of the United States, except a white, very slender and delicate one which is common on a part of the southern coast of Florida, and a single specimen of Ditrupa gadus, which came up on the lead in deep water in the Gulf of Mexico. This species is also a Miocene fossil in Virginia.

DENTALIUM THALLOIDES. Slightly curved, most so towards the apex, where it is rather suddenly bent; ribs prominent, striæform, alternating with fine lines; the lines sometimes double; ribs most prominent towards the apex, becoming obsolete near the base; aperture round. (Plate I, fig. 2.)

Dentalium thalloides, Con., Foss. Shells of Tert. Form., p. 34, August, 1833.

D. alternatum, Lea, Cont. to Geol., Plate I, fig. 2, Dec. 1833.

Claiborne, Alabama.

This species is abundant and very elegantly striated. It is delicately pointed and thin at base. In Chenu's splendid work there is an excellent figure of it.

DENTALIUM ARCIFORMIS. Regularly curved, tapering very gradually, round, polished, very thick at the apex. (Plate I, fig. 3.)

Claiborne, Alabama.

I have but three imperfect specimens of this species, and they do not suffice to exhibit the complete outline of the shell. It is much more elongated and tapering than Lea's D. turritum, which I have not seen. The turrited form of the superior margin of the latter species is probably accidental, the result of fracture.

ANGUINELLA.

I propose this name for a genus resembling Serpula in external characters, but distinguished by its numerous internal vaulted septa, which are entire or enclose chambers without a channel of communication. I find two species only, one of which occurs in the Miocene of Virginia.

ANGUINELLA ORNATA. Contorted, glomerated, with irregular transverse furrows and longitudinal unequal striæ, which are roughened by granulations, frequently obsolete. (Plate I, fig. 4.)

Serpula ornata? Lea, Cont. to Geol., Plate I, fig. 5.

S. squamulosa, Con., Journ. Acad. Nat. Sci., Vol. vii, p. 149.

Claiborne, Alabama.

This species is rare; it is occasionally convoluted, and when this is the case, one side is flattened, and attached to other specimens or to other shells, &c.

FISTULANA.

The genus Fistulana, Lam., has not been noticed in a formation below the Eocene strata, and there are few species in a fossil state. I have met with one only either recent or fossil as an American species. Deshayes has found six species in the Eocene of Paris.

FISTULANA LARVA. Ovate-oblong, ventricose; thin and fragile; anterior margin short, straight, very oblique; extremity angulated; posterior margin regularly rounded; ambonial slope defined by impressed lines; concentric lines on the anterior half of the shell rough and prominent; basal margin slightly arched. (Plate I, fig. 5.)

Claiborne, Alabama.

This rare species is allied to F. elongata, *Desh.*; but is proportionally shorter and very distinct.

BALANUS.

One species of this genus occurs in the Eocene limestone of South Carolina, and I know none of earlier date. The large Miocene Pectens are frequently covered with large and small species. Six recent Balani have been described as inhabitants of the Atlantic coast, of which, one only, B. ovularis, has been discovered in the miocene.

BALANUS PEREGRINUS. Subovate; valves longitudinally striated and obscurely sulcated transversely; the large valves curved towards the narrow end of the aperture; aperture large, acutely ovate. (Plate I, fig. 6.)

Balanus peregrinus, Morton; Synopsis of Organic Rem. of Cretac. Group, p. 72, Plate X, fig. 5.

Near Santee canal, South Carolina.

This shell is remarkably perfect and retains part of its original reddish color. I discovered it in white friable limestone, between Charleston and the Santee canal.

PHOLAS.

The genus Pholas has been discovered by Sowerby and Phillips, in the coral rag, Kimmeridge clay and gault. The oldest species known in this country, is the one I found in the Eocene. There is one other species in the Miocene strata of Virginia. Deshayes enumerates nine in the European tertiaries, three of which belong to the Paris Eocene. We find five recent species on the coasts of the United States, two of which are limited to the southern coast.

PHOLAS PETROSA. Ovate-acute; anteriorly profoundly ventricose, the extremity truncated, not very obliquely; posterior side cuneiform; surface with numerous acute unequal radii; dorsal margin declining, subrectilinear; basal margin nearly rectilinear. (Plate II, fig. 1.)

Pholas petrosa, Con.; Proceed. Nat. Inst., p. 193, Plate II, fig. 4.

Piscataway, Prince George's Co., Md.

Occurs in an indurated marl at the summit of the Eocene, and is rare and imperfect; generally in casts, with a trace of the shell remaining.

PHOLADOMYA.

I believe this interesting genus first appears in the Oolite group. Several species from rocks of that period have been described by Sowerby. M. Marcel de Serres described a species in the tertiary marls of the south of France, and one recent species has been figured and described by Sowerby in his "Genera of Shells." This inhabits the West Indies. In this country the oldest species we find is from the cretaceous strata. Two tertiary species have been described by myself; one belonging to the Eocene, the other to the Miocene period. The latter has been erroneously referred to Panopæa by Deshayes. From that genus it widely differs, in having a pearly nacre and in being destitute of cardinal teeth. The young or middle aged shells are extremely fragile, and have scarcely a trace of the muscular or palleal impressions, resembling in this respect, the recent species, with which the hinge also corresponds.

PHOLADOMYA MARYLANDICA. Ovate, profoundly ventricose, with coarse, irregular concentric lines and furrows, and obsolete, rather indistinct radii; umbo summit prominent; anterior side very short, the extremity subtruncated; basal margin rounded; posterior extremity rounded. (Plate I, fig. 9.)

Pholadomya Marylandica, Con.; Proceed. Nat. Inst., p. 193, Plate I, fig. 3.

Piscataway, Md.

This rare shell accompanies Pholas petrosa, and is in the same state of preservation. Little of the shell remains, and that exhibits the pearliness which no doubt characterized all the species, and which prominently distinguishes this genus from Panopæa.

PANOPÆA.

The genus Panopæa, of Menard de la Groye, embraces few recent species. Sowerby has described one from the Great Oolite and another which is supposed to occur in the Green Sand formation. Deshayes enumerates three fossil species, one in the Eocene of Paris, the other in Miocene deposites. In this country, I find one in the Eocene of Maryland, and four in Miocene strata. I once obtained a large recent species at Mobile Point, Alabama, which was lost before I had determined its relation to others. I have revisited this and the neighboring coasts without finding another specimen.

PANOPÆA ELONGATA. Ovate-oblong, ventricose, contracted from beak to base; posterior side produced; umbo summit prominent; posterior extremity acutely rounded; beaks distant from anterior margin; anterior side of the umbo subangulated. (Plate II, fig. 2.)

Panopæa elongata, Con.; Trans. Geolog. Soc. of Penn., Vol. i, p. 339, Plate XIII, fig. 1.

Piscataway, Md.

Allied to Panopæa intermedia of Sowerby, but proportionally much longer, with more of a cuneiform posterior side, &c. It accompanies Pholas petrosa and Pholadomya Marylandica, consisting of indurated casts, coated with a portion of the shell. It is very abundant, having the valves connected, like the associated bivalves, proving that the species lived on the spot where it is now found. The stratum in which it is imbedded is the summit of the Eocene, and is of inconsiderable thickness. It bears no evidence of having been deposited in agitated waters.

LUTRARIA.

The genus Lutraria of Lamarck, was unknown to Deshayes in the European Eocene formation in 1833, but he noticed a few species in the Miocene strata. Sowerby has referred some shells of the Inferior Oolite, green sand and chalk to this genus, but perhaps the hinge was not observed, and the generic character may be therefore doubtful. In this country, I find two species in the Eocene, and Say has described two recent species from the southern coast. In the Miocene strata, I have not met with the genus. The Post-pliocene of North Carolina, contains the recent L. canaliculata, Say.

LUTRARIA LAPIDOSA. Obliquely ovate, convex, with rather distinct large concentric sulci, obsolete towards the base; summits very elevated, from which the anterior and posterior dorsal margins decline very obliquely; anterior extremity angulated; posterior side cuneiform towards the end margin, which is acutely rounded or subangulated; anterior basal margin very oblique, subtruncated. (Plate I, fig. 7.)

Orangeburg, S. C.

I have but one specimen, a cast in indurated clay, without a trace of the original shell remaining upon it.

Lutraria papyria. Ovate, very thin and fragile, inflated anteriorly; surface with concentric sulci, profound on the sides and obsolete in the middle, and with numerous interrupted wrinkled lines from umbo to base; anterior end abruptly rounded; posterior side cuneiform, compressed, gaping; a slight fold, and nearer the end margin, an undulated line from beak to base; submargin angular, with a narrow depressed area at the extremity of the valves. (Plate I, fig. 8.)

Lutraria papyria, Con.; Foss. Shells of Tert. Form., p. 41.

Claiborne, Alabama.

A very rare species and extremely fragile. I have only one valve nearly perfect and the fragment of another. The teeth and cardinal grooves are remarkably large and profound.

MACTRA.

The genus Mactra appears to be peculiar to the tertiary formations in a fossil state. I have seen no unquestionable species in secondary rocks. Deshayes enumerates fifteen fossil species of Europe, two of which are in the Paris Eocene. I find three species in the Alabama Eocene, all of which are small. The Miocene strata of Maryland and Virginia contain the largest known species, excepting the recent M. solidissima. This formation has furnished ten species. Four recent Mactræ inhabit the eastern and middle coasts of the Union. One of these, M. lateralis, is common in the Gulf of Mexico on many of the Keys, and occurs fossil in Virginia and North Carolina both in Miocene and Post-pliocene deposits.

This genus has been subdivided by Gray into the genera Spisula, Scissodesma and Mulinia. I have no doubt the anatomical structure of the animals of these three groups will, when better known, authorize the genera of this distinguished naturalist.

Mactra decisa. Triangular, ventricose, umbonial slope angular, slightly carinated; posterior slope much depressed, with a line somewhat bifid or double from beak to base, and short oblique prominent lines on the upper portion of the valves; cardinal fosset large and profound, the anterior tooth adjoining it triangular, with a deep pit on each of the three sides. (Plate II, fig. 3.)

Mactra decisa, Con.; Foss. Shells of Tert. Form., p. 42, Oct. 1833.

M. dentata, Lea; Cont. to Geol., p. 41, Plate I, fig. 9. Dec. 1833.

Claiborne, Alabama.

This very rare species has not been found entire. I have only one fragment, and the hinge of this is perfect enough to exhibit the fissure in the hinge line under the apex, which characterizes the genus Scissodesma.

MACTRA PARILIS. Triangular, equilateral, smooth and polished; both ends depressed and striated; umbonial slope slightly folded; anterior angle with an impressed line; cavity capacious. (Plate II, fig. 6.)

Mactra parilis, Con.; Foss. Shells of Tert. Form., p. 42, Oct. 1833.

M. pygmæa ? Lea; Cont. to Geol., p. 44, Plate I, fig. 11, Dec. 1833.

Claiborne, Alabama.

This species has some resemblance in outline to the M. lateralis of Say, but its specific character is very different. It probably belongs to the genus Mulinia.

MACTRA PRÆTENUIS. Subtriangular, compressed, equilateral, thin and fragile; umbonial slope submarginal, subrectilinear, carinated; beaks slightly prominent; posterior slope with two prominent fine lines and obliquely rugose; surface of the valves with very minute concentric closely arranged lines. (Plate II, fig. 4.)

Mactra prætenuis, Con.; Foss. Shells of Tert. Form., p. 42.

Claiborne, Alabama.

This shell is very rare. It has somewhat the outline of M. delumbis, of the Miocene, but is a much smaller and very distinct species. It has the cardinal fissure which would constitute it a member of the genus Scissodesma.

TRIQUETRA, *Con.*

This genus differs from Mactra and Mesodesma in having a less profound and much smaller cardinal fosset, which does not extend more than half the width of the cardinal plate, which is broad and thick. The substance of the shell is thicker than in Mactra, and the anterior muscular impression more profound. Exteriorly this genus is distinguished by a triangular outline, flattened umbo and acute apex which is scarcely oblique. It does not agree with either Scissodesma or Mulinia.

In a fossil state we find only the two following species. I have seen none recent.

Triquetra æquorea. Triangular, equilateral, thick, plano-convex; umbonial slope submarginal, angulated; umbo flattened, apex acute; anterior extremity acutely rounded; posterior extremity obliquely truncated; cardinal plate very thick; fosset small, ovate; cardinal plate thickest under the anterior cardinal tooth. (Plate II, fig. 5.)

Erycina æquorea, Con.; Foss. Shells of Tert. Form. p. 42, Oct. 1833.

Mactra Grayi, Lea; Cont. to Geol., Plate 1, fig. 10.

Claiborne, Alabama.

A common species, the valves of which are always found separated. The substance of the shell is remarkably thick.

Triquetra rectilinearis. Triangular, flattened above, with coarse lines of growth; posterior side subcuneiform, rather longer than the anterior side, extremity subtruncated; umbo much flattened, apex acute; posterior dorsal margin rectilinear; basal margin a little tumid near the middle. (Plate II, fig. 8.)

Erycina rectilinearis, Con.; Foss. Shells of Tert. Form. p. 42.

Claiborne, Alabama.

This shell is larger, thinner, more inequilateral than the preceding, and very rare. The cardinal plate is less thickened and the anterior muscular impression not so deeply impressed. Both species have an indistinct impressed line on the exterior, extending from the anterior end to the apex.

Explanation of Plates.

Plate I.

Fig. 1. Siliquaria vitis.
2. Dentalium thalloides.
3. D. arciformis.
4. Anguinella ornata.
5. Fistulana larva.
6. Balanus peregrinus.
7. Lutraria lapidosa.
8. L. papyria.
9. Pholadomya marylandica.

Plate II.

Fig. 1. Pholas petrosa.
2. Panopæa elongata.
3. Mactra decisa.
4. M. prætenuis.
5. Triquetra æquorea.
6. Mactra parilis.
7. Crassatella protexta.
8. Triquetra rectilinearis.

List of organic remains in the American Eocene which are analogous to European species.

1. *Crassatella alæformis*, Con. Very much like C. rostrata, Desh. in outline, but differs in having sulci over the whole disk.
2. *C. alta*, Con. Approaches very near to C. tumida. (Paris.)
3. *Fistulana larva*, Con. Allied to F. elongata, Desh. (Paris.)
4. *Corbula oniscus*, Con. Closely allied to F. angustata, Sow., and resembles C. ombonella, Desh.
5. *Panopæa elongata*, Con. Allied to P. intermedea, Sow. (Bognor Rocks, England.)
6. *Lucina lapidosa*, Con. Allied to L. contorta, Desh., but is much more elevated.
7. *Lucina symmetrica*, Con. Allied to L. scalaris, Lam. (Paris.)
8. *Cytherea Mortoni*, Con. Analogous to C. erycinoides, Lam., and to C. suberycinoides, Desh. (Paris.)
9. *C. semipunctata*, Con., has a general resemblance to C. lævigata, Lam.
10. *Cardita Blandingi*, Con. Analogous to C. acutiscosta, Lam. (Paris.)
11. *C. rotunda*, Lea. Analogous to Venericardia asperula, Desh. (Paris.)
12. *Cardium Nicolleti*, Con. Closely analogous to C. semigranosum, Sow., (Paris,) and resembles C. semistriatum, Desh., but differs in having radiating lines over the whole disk.
13. *Cucullæa gigantea*, Con. Very like C. crassatina, Lam. (Paris.)
14. *Byssoarca cuculloides*, Con. Somewhat resembles Arca rudis, Desh. (Paris.)
15. *Pectunculus idoneus*, Con. Closely appproaches a Paris species in my cabinet which I do not recognize among Deshayes' figures of the Paris fossils.
16. *Avicula limula*, Con. Analogous to A. trigona, Lam. (Paris.)
17. *Ostrea georgiana*, Con. Allied to O. longirostris, Lam.
18. *Turritella Mortoni*, Con. Analogous to a species in the London clay.
19. *T. humerosa*, Con. Closely allied to T. imbricataria, Lam. (Paris.)

20. *Fusus perlatus*, Con. Resembles F. ficulneus. (Paris.)
21. *F. pachyleurus*, Con. Allied to F. conjunctus, Desh. (Paris.)
22. *Rostellaria laqueata*, Con. Very analogous to R. fissurella, Lam. (Paris.)
23. *Voluta Sayana*, Con. Allied to V. luctator, Sow. (London clay.)
24. *V. petrosa*, Con. Closely allied to V. spinosa. (Paris.)
25. *Oliva alabamensis*, Con. Allied to O. plicaria, Lam.
26. *O. bombylus*, Con. Allied to O. clavulus, Lam.
27. *Ancillaria staminea*, Con. Allied to A. canalifera, Lam. (Paris.)
28. *Monoceros vetusta*, Con. Very nearly allied to Murex minax, Brander, (Fusus minax, Lam.) (London clay and Paris.)

Note.—I add here a few remarks upon some tertiary fossils recently described by Mr. Lonsdale and Mr. Forbes, in the Proceedings of the Geological Society of London, iv, part 3.

Anthophyllum lineatum, Lonsdale. This Miocene coral I figured and described in the Transactions of the Geological Society of Pennsylvania, i, 340, pl. 13, fig. 4, 1835, where it bears the name of *Lithodendrum lineatum.*

Astræa hirtolamellata, Michelin. The species thus designated by Lonsdale is named by me *Astræa marylandica*, in the Proceedings of the Academy of Natural Sciences of Philadelphia, for June, 1841, p. 33.

Amphidetus virginianus, Forbes. This echinoderm is described by me in the Proceedings of the Academy of Natural Sciences, for Dec., 1843, vol. i, p. 327; and is there named *Spatangus orthonotus.* If the generic name be changed, the species should stand as the *Amphidetus orthonotus.*

Echinus Ruffinii, Forbes. This species appears to be identical with my *E. philanthropus*, in the Proceedings of the Academy of Natural Sciences of Philadelphia, for Oct. 1843, vol. i, p. 310.

Endopachys alatum, Lonsdale. This is the *Turbinolia Maclurii* of Lea, and is figured in the *Contributions to Geology*, Plate VI, fig. 206. Lonsdale's figures *b*, *c*, of another species of Endopachys, represent apparently the *Turbinolia Stokesii* of Lea; *Contributions to Geology*, Plate VI, fig. 207.

Additional Remarks, by J. D. Dana.—The genus *Endopachys* of Lonsdale includes certain Turbinoliæ, either turbinate or cuneiform, with the base and sides rather thick and porous, and resembling much in texture and the lamellæ of the cells the Dendrophylliæ. The thickening of the corallum is described as taking place from within through foramina, and upon this character the genus is founded, and to it the name alludes—from *ενδον within*, and *παχυς thick*. On an examination of specimens of the same species figured by Lonsdale, I see no evidence of this anomalous mode of secretion; they appear very similar in character to some Dendrophylliæ, except that they are free and simple, and are different in shape, and exterior markings. After an examination of numerous coral zoophytes in the living state, I am led to doubt the propriety of the grounds upon which the genus is based. But one principle as regards the secretion of coral, runs through all the species of the Caryophyllia and Astræa tribes, as far as examined by the writer, and in all instances they appear to be internal secretions, very analogous in mode of formation to the calcareous secretions of other animals.

The *Madrepora tubulata* of Lonsdale, in the same memoir, is an *Oculina*.

The *Columnaria sexradiata*, is allied to the Astræa calicularis of the Mediterranean, for which I have adopted as a generic name, *Astroitis*, from Boccone. The recent species is characterized by long prominent polyps when expanded, and has not the terminal mode of budding which distinguishes the genera of the Astræa tribe. The subdivision of polyps which takes place in most Astræas is the result of disk-budding; but in these species the polyps are only united to one another at base, and the buds are therefore basal or lateral, instead of terminal, and make their appearance in the interstices. The exposed polyps are prominent, because they secrete lime only in their lower or basal portions.

The species referred to the *Astræa hirto-lamellata* of Michelin by Lonsdale, is closely allied to the preceding, and either belongs to the same genus, or to the group *Pleiadia* of the writer, which is distinguished from *Astroitis* by having the cells of the corallum solidly coalescent. An allied species before me has the interstitial mode of budding of the Astroites, and judging from analogy, the polyps were probably prominent, as in that genus.

ART. VIII.—*An account of the Geology of Harpeth Ridge, Davidson Co., Tenn.;* by I. N. LOOMIS, Franklin College, Tenn.

DURING a geological exploration of a few days, by a number of the students and faculty of Franklin College, Tennessee, a few observations and discoveries were made, an account of which may be of interest to the readers of your Journal.

The college is four miles east from Nashville, and our course from this point was in a southwesterly direction, on the old Franklin road to the Harpeth ridge, bordering the Harpeth river, a branch of the Cumberland, entering it about twenty miles below Nashville.

The formations of this region, belong to the Lower Silurian, and we were able to identify most of them with the corresponding ones of New York and Ohio. The first of these was that corresponding with the blue shaly limestone of Ohio and Kentucky, and exposed for several miles around Cincinnati, which, according to Mr. James Hall, is identical with "the rocks of the Mohawk and Hudson valleys in New York."*

In Middle Tennessee, the rocks dip to the south, and we came on to this one at the base of the ridge, which at this place is from fifty to sixty feet in thickness. The evidences of identity between these two formations are full and satisfactory. Two or three species of Delthyris; a well defined Trochus; a beautiful encrinite; Orthis testudinaria, O. callactus, and several other species; a very small Atrypa, abundant at Cincinnati, and named by the Western Academy of Sciences, Atrypa communis; numerous corallines, among which are the Favosites muricata, F. milliporacea, and a beautiful star coral; Strophomena sericea, S. alternata, and one or two others; and a species of Bellerophon, were all found here, which, on comparison with those procured at Cincinnati, could not be distinguished from them, by a close examination.

Were farther proof of their identity wanting, it might be found in the microscopic shells in the marly clay accompanying them, discovered by Mr. J. Carley at Cincinnati, and described by Mr. James Hall in a previous number of this Journal.† These were found in large quantities, beautiful and perfect, besides several species not described, and some microscopic corallines. As regards their lithological characters, there was observed sufficient resemblance in their color and texture, to lead to the conjecture of their correspondence, before examining the fossils.

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* This Journal, Vol. XLVIII, p. 293. † Vol. XLVIII, No. 2d.

Immediately above this, occurs a yellowish brown calcareous rock, about ten feet in thickness, containing numerous small cavities, filled with quartz crystals.

In this were found no fossils, except in the upper stratum, where were obtained a small Orthis in great abundance, several species of coral, a Delthyris and Cyathophyllum. Next in order is a red limestone, which on disintegration furnishes a material, resembling Spanish brown. The red color of many of the microscopic shells mentioned above, suggested an examination in this rock. In it were discovered the Cyclora and Nucula. Thickness from six to eight feet.

The next formation identified was a peculiar one, corresponding with a portion of the Niagara group of New York, developed at Lockport, and usually termed the red encrinal limestone. It is composed chiefly of fragments of encrinital columns, many of which are colored red. Being perfectly familiar with that at Lockport, I have little hesitation in pronouncing this the same, for they possess peculiarities of color and structure not easily mistaken—the latter being furnished by the fracture of the plates composing the encrinal columns. Allowing that some of the formations of New York are wanting here, its stratigraphical position is also favorable to this conclusion. It is about twenty feet in thickness. Above this, is found a light snuff-colored rock, which also contains the microscopic shells; and on examination with a powerful magnifier, it seems almost entirely composed of them. From this they are doubtless chiefly furnished, as its color corresponds with the marl and disintegrated rock in which they are found, as also the color of the shells, except some that are red. This, on the north side of the ridge, is but three or four inches thick, but on the opposite side, about one mile south, it is about fifteen inches in thickness.

Next occurs a stratum of shale from twelve to fifteen feet in thickness. Although upon minute examination, no traces of organic remains were found in it, yet there is little doubt of its identity with the Marcellus shales, or "pyritiferous" of Eaton in New York, as will be seen when its position is more fully described. At a place several miles below this, on the east bank of the Harpeth, we examined a well exposed section of about one hundred feet. In it, and between the red encrinal limestone and the shale, occurs a formation of limestone, of a dark color, filled with masses of chert, and in appearance resembling the "corniferous" of New York. Although we had but a short time to examine it, I doubt not it is the same. By a reference to the reports of Dr. Troost, geologist of Tennessee, it will be seen that the strata of this region often run out, and others occur within the space of a few miles. No traces of the last mentioned rock were found at the former place of examination, yet the whole region is strown with fragments of chert, which have doubtless been furnished from it.

Another evidence of the identity of the shales is a stratum of limestone found in them. At the mouth of Eighteen Mile Creek, on the south shore of Lake Erie, eighteen miles from Buffalo, a stratum of limestone, three or four feet in thickness, may be seen projecting from the shale near the top of the bank, and having fallen in numerous masses on the beach.

It contains large irregular masses of iron pyrites. The shale at Harpeth contains a similar stratum of less thickness, but resembling it in structure and external appearances, except being somewhat darker, and contains similar masses of sulphuret of iron. The shale also contains pyrites in minute particles, and a considerable quantity of bitumen—both characteristics of the Marcellus shale, the latter circumstance having led to numerous excavations in them both, in search of fossil coal.

But the character of the shale, as well as that of the rock containing the chert, is satisfactorily determined by the two which succeed it, and cap the hills in this vicinity. These are the Gardeau or Lower Fucoidal, and the Portage or Upper Fucoidal groups of New York. Mr. Hall in his report for 1840 remarks, that no formations in the state are better characterized than these, and that almost the only fossils they contain, are the Fucoides graphica in the former, and F. verticalis in the latter. In both of the strata next above the shale, these fossils were respectively found, and so nearly resembling those of the Gardeau and Portage groups in appearance and position, as not to be mistaken. In these were also found those nodular concretions often met with in the other. Besides the composition, the peculiar olive color and all the external characters of these rocks are easily recognized.

Art. IX.—*Notice of some Genera of Cyclopacea*; by J. D. Dana.

As a preface to the descriptions which follow, a classification of Crustacea is here given; it is made out so as to exhibit to some extent the parallel relations of the several orders and subdivisions.

CRUSTACEA.

Subclassis I. PODOPHTHALMIA.	Subclassis II. EDRIOPHTHALMIA.			Subclassis III. MANDYATA.‖
Ordo 1. Decapoda. Tribus 1. Brachyura. 2. Anomoura. 3. Macroura.	Ordo 1. Choristopoda.* Tribus 1. Isopoda. 2. Læmipoda. 3. Amphipoda.			
Ordo 2. Schizopoda.	Ordo 2. Entomostraca.			
	Subord. 1. Gnathostomata.†	Subord. 2. Cormostomata.‡	Subord. 3. Merostomata.§	
Tribus 1. Stomapoda. 2. Diploöpoda.	Tribus 1. Branchipodacea. 2. Limnadiacea. 3. Daphniacea. 4. Cyclopacea. 5. Cypridacea.	Tribus 1. Caligacea. 2. Lernæacea. 3. Nymphonacea.	Tribus 1. Limulacea.	Tribus 1. Cirripeda, or Balanacea.¶
	Ordo 3. Trilobita.			

Order ENTOMOSTRACA.

Tribe Cyclopacea.

To avoid explanations in the following descriptions, we here enumerate the prominent external characters of this tribe.

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* From χωριστος *separate*, and πους *foot*, alluding to the fact that the pairs of feet belong each to a distinct segment of the body.

† From γναθος *jaw*, and στομα *mouth*, alluding to the mouth being furnished with proper mandibles and maxillæ.

‡ From κορμος *trunk*, and στομα *mouth*, the mouth having the form of a movable trunk.

§ From μηρος *thigh*, and στομα *mouth*, the basal joints of the legs constituting the jaws.

‖ From μανδυη *a cloak*, alluding to the covering in which the body of the animal is enclosed.

¶ The Cypris-like young of several Anatifæ were collected and figured by the writer, and the metamorphosis traced to the adult state. When first found swimming free in the ocean, they were taken for a new genus allied to Cypris, so similar are their forms. The fact that the body and legs of the Cirripeda shed their skin, is further evidence of the propriety of placing this group with Crustacea.

The pedicel of the Anatifæ corresponds to a pair of antennæ in the young; the animal attaches itself by the sucker-like disk terminating these organs before the metamorphosis commences, and in a group of Anatifæ all the different stages may be observed, from the pair of distinct antennæ to the fixed simple pedicel.

Body jointed, the carapax not prolonged beyond the joint to which it belongs; *abdomen* not inflexed.

Eyes simple.

Antennæ two pairs; the second often pediform or subcheliform.

Mandibles 4–5-spino-dentate, sometimes having a subnatatory palpus.

Maxillæ, one pair; sometimes with a subnatatory palpus.

Maxillipeds, one pair; sometimes simple maxillæ; at others, prehensile, but never at all natatory.

Feet, 6 pairs; the *first* often prehensile, and subcheliform, and either straight or geniculated; *next four* pairs, bifid and natatory; the *sixth* or *posterior*, (corresponding to another pair of natatories,) rudimentary or obsolete, but in some genera, large in the male, with the right one subcheliform.

Abdomen, 2 to 6-jointed; two caudal appendages furnished with 5 setæ, some of which may be obsolete; occasionally short appendages to one or both of the first and second joints.

External ovaries, one or two, proceeding from the *second* joint of the abdomen, or what corresponds thereto.

The genera of this tribe here described may be distributed as follows:

1. *Palpi of the mandibles and maxillæ obsolete or wanting, eyes with simple spherical lenses.*

Family 1. CYCLOPIDÆ. External ovaries two. Eyes two, on a single spot of pigment. Abdomen abruptly narrower than the cephalo-thorax.

Genus 1. CYCLOPS, *Müller*. The two anterior antennæ subcheliform in the male. (Fresh-water species.)

Family 2. ARPACTIDÆ. External ovary single. Eyes two on a single spot of pigment. A short appendage near middle of anterior antennæ. Abdomen seldom abruptly narrower than the cephalo-thorax. (Marine species.)

Genus 1. ARPACTUS,* *Milne Edwards*. Anterior antennæ short, and both, in the male, subcheliform; posterior pair terminating in a number of movable setæ. Prehensile feet subcheliform.

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* Milne Edwards has instituted the genus Cyclopsina for a group near Arpactus having the posterior maxillipeds not subcheliform. In the species examined by the writer the subcheliform character is constant, but the movable finger is sometimes reduced to a very short hook.

Genus 2. SETELLA, *Dana.* Anterior antennæ moderately long, slender, and not subcheliform in the male; posterior pair and prehensile feet nearly as in *Arpactus;* short appendages to the first two joints of abdomen; body slender, and two caudal setæ much longer than the body. (Two movable appendages under the beak.)

The name Setella alludes to the *seta*-like form of the animal, and is from *seta*, a bristle.

2. *Palpi of the mandibles and of the maxillæ prominent, and subnatatory.*

Family 3. CALANIDÆ. External ovary single. Eyes two, the spherical lenses on the same or separate spots of pigment. Anterior antennæ very long and slender, without an appendage. Abdomen abruptly narrower than the cephalo-thorax. (Marine species.)

a. Posterior thoracic legs rudimentary or obsolete, without appendages. Anterior antennæ alike in the two sexes, and never with a geniculating joint.

Genus 1. CALANUS, *Leach.* Cephalo-thorax 4-jointed. Anterior antennæ multiarticulate, with the front margin neatly setiferous, and also the posterior apices of the three terminal joints; first pair of feet much larger than the maxillipeds, having outward lateral motion, but scarcely prehensile; maxillipeds very short and straight, setigerous; abdomen short, 2 to 4-jointed. Beak furcate.

Genus 2. SCRIBELLA, *Dana.* Cephalo-thorax 4-jointed. Anterior antennæ, long 7-jointed; setæ long and pointing in different directions. Maxillipeds much larger than the first pair of legs, flexed forward, the three terminal joints as long as the basal, and setigerous, the setæ setulose. Abdomen very long, (as long as the cephalo-thorax;) two setæ to the short basal joint; (a plume or capillary appendage to base of the 8 natatory legs, extending outward at right angles with the body.)

Genus 3. ACARTIA, *Dana.* Anterior antennæ few-jointed; setæ long and pointed in different directions; maxillipeds much larger than the first pair of legs, not flexed, having the terminal joints very short, and setigerous nearly as in the genus *Pontella;* the first pair of legs small and short, not prehensile; the posterior thoracic legs, a single small joint bearing two divergent setæ, one quite long, and usually standing out from the body.

The name Acartia is from *ακαρτος unshorn*, alluding to the long divaricate hairs of the antennæ.

b. Posterior thoracic legs very long and nearly equal; antennæ of the two sexes alike, without a geniculating joint.

Genus 4. Euchirus, *Dana.* Anterior antennæ many-jointed, with several long setæ at intervals; first pair of feet much larger than the maxillipeds, very long and doubly geniculate, the apex flexed downward and furnished below with a pencil of naked setæ; motion of these organs forward in the line of the body, and not outward. Posterior thoracic legs in male very long, and the right one subcheliform. Beak pointed, in lateral view emarginate.

c. *Posterior thoracic legs in the male large, the two unequal, and the right subcheliform; the right one of the anterior antennæ in the same sex having a geniculating joint about one third its length from the apex.*

Genus 5. Pontella.* Anterior antennæ multiarticulate, the setæ as in *Calanus.* Maxillipeds much larger than the first pair of legs, not flexed, and having the terminal joints short and setigerous, the setæ extending forward to the mouth and setulose, as in *Acartia;* the first pair of legs small and short, not prehensile. The right posterior thoracic leg in the male large cheliform, the left smaller and often simple. Beak furcate. Caudal setæ more or less spread. (There is a large glassy appendage under the head, with a rounded or reniform summit.)

Genus 6. Candacia, *Dana.* Anterior antennæ and posterior thoracic legs, nearly as in *Pontella;* the first pair of legs much larger than the maxillipeds, elongate, and flexed forward, with the extremity inflexed and bearing a pencil of long naked setæ, motion in the line of the body. Front truncate; caudal setæ usually not spread. Color often in part black or nearly so.

3. *Palpi of the mandibles and maxillæ obsolete; two simple eyes?; also two oblate lenses in the front, and two prolate lenses posterior to these within, which may constitute another pair of eyes.*

Family 4. Corycæidæ. Tentacles short, few-jointed; external ovaries two.

Genus 1. Corycæus,† *Dana.* Body not depressed. Abdomen abruptly narrower than the body, 2 or 3-jointed; second pair of antennæ subcheliform, larger than the first pair of legs, (nearly as in the genus Ergasilus.)

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* The name Pontia, applied to this group by Milne Edwards, was previously applied to a genus of insects, and has therefore been changed as above. The genus *Cetochilus* of Roussel de Vauzème does not differ essentially from Pontella.

† See Proceed. of Acad. Nat. Sci. of Philad. for October, 1845, p. 285. The two lenses in these animals are separated by an unobstructed space, and appear beyond doubt to serve for the transmission of light. In contact with the posterior lens behind is an oblong spot of dark pigment. The only other supposition with

Genus 2. Antaria, *Dana*. Similar to *Corycæus*, but having the second pair of antennæ terminating in a few movable setæ, and smaller than the first pair of legs. (I am not satisfied that these specimens are not the female of the Corycæi.)

Genus 3. Sapphirina, *Thompson*. Body much depressed; antennæ as in *Corycæus;* abdomen 5 or 6-jointed, the basal joint in the female abruptly narrower than the thorax, and having a pair of short appendages; external ovaries two.

Family 5. Miracidæ. Antennæ as in *Setella;* external ovary single.

Genus 1. Miracia, *Dana*. Body not depressed, nearly as in the *Arpactidæ*, the abdomen 5 or 6-jointed and not abruptly narrower than the thorax; anterior antennæ nearly as in *Setella*, with a short appendage near the middle; second pair of antennæ terminating in a few movable setæ; beak with two cultriform appendages; first pair of legs subcheliform.

The distinctions in the above genera rest to a considerable extent upon the use of different organs for grasping in the union of the sexes. In *Cyclops* and *Arpactus*, both anterior antennæ of the male are subcheliform for this purpose; in *Pontella* and *Candacia*, the right antenna and right posterior thoracic leg is thus modified in the male; in *Euchirus*, both posterior thoracic legs are very much elongated; in *Calanus*, the first pair of legs are long and have an outward lateral motion for the purpose; in *Corycæus* the second pair of antennæ subserves this end, and in *Antaria* the first pair of legs are large and subcheliform; in *Setella* the same end appears to be secured by the first pair of natatories.

The genera of Calanidæ differ also in the relative development of the maxillipeds and first pair of legs. In *Pontella*, *Acartia*, and *Scribella*, the maxillipeds are largest. In *Pontella* and *Acartia* they are straight, with long setulose setæ directed forward so as to form a kind of scoop-net. In *Scribella* they are flexed like the letter L. In *Calanus*, *Euchirus* and *Candacia*, the first pair of legs are larger than the maxillipeds; in *Calanus* they are long

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regard to their nature which I can suggest, is their possible connection with phosphorescence. But such an arrangement for this end is not probable; and moreover I was never satisfied that the species were phosphorescent.

and spread outward laterally; in *Euchirus* they are thrown forward in the line of the body, and are flexed like the letter И; and in *Candacia* they have nearly a similar position, but have the extremity flexed *towards* the head instead of *away* from it.

The maxillipeds may always be distinguished from the first pair of legs by the setæ, which are *setulose* in the former, and *naked* in the latter.

ART. X.—*On the Law of Electric Conduction in Metals;* by JONATHAN H. LANE.

MY attention was first directed to the subject of the law of conduction by reading a paper by Prof. Morse, published in this Journal, Vol. XLV, p. 390, first series, accompanied by a communication from Prof. Draper. These communications gave me the impression that the law commonly received was not well ascertained, and it was under this impression that the experiments given in the following paper were made. But since it was written, I have found that I had mistaken the particular aim of Prof. Morse's experiments, which did not profess superior accuracy, but were only intended as experiments on a large scale by way of verification. Experiments have long since been made by different electricians, which afford strong support to the law in question, while others were thought to controvert it; but they have either been explained, or are not in their nature satisfactory. Still, my own method of experiment appears to possess advantages over any that I have seen; and notwithstanding the imperfect manner in which it has been carried out, it has given results more exactly corresponding with the supposed law. I must say, however, that my experiments have by no means been sufficiently extended, for those given are all I have made touching this question.

1. Supposing electricity to be a fluid, and an electric current to be no more than the motion of this fluid through a conductor, which, at the same time, opposes a resistance to its motion, it is a natural inference, that as electric motion is known to result from difference of tension, so conversely, there is always a difference of tension in the different parts of a conductor, while conducting a current—a regular gradation in the quantity of elec-

tric fluid, from one end to the other, as in the height of flowing water in a canal, and more or less rapid or abrupt, according to the conducting power of the different parts of the conductor.

Hence we should expect that if any two points of such a conductor, however near together, were connected by a second conductor, of whatever length, a current would at once flow through the latter. Accordingly, the poles of an ordinary galvanic battery being connected by a good metallic conductor of two or three feet length, the current generated in a second conductor was made instantly apparent; when it included between its extremities not more than a half inch of the battery conductor, and the effect, as might be expected, increased in proportion to the interval between the extremities of the second conductor. This satisfied me that by such experiments as I had proposed, the law of conduction could be ascertained with much certainty.*

2. The law of Lenz embraces two propositions.

(1.) In a given conductor, the quantity of fluid conducted in a given period, is as the intensity, or difference of tension between the ends of the conductor.

(2.) In homogeneous conductors of the same length, and with the same difference of tension, the quantity conducted is as the section.

3. To test the truth of the first of these propositions, we divide the current of one or more wires, among two or more others of the same size, and then compare a given length of the former wire or wires, with such length of the latter as shall have the same difference of tension. If, for example, part of a galvanic circuit be composed of a single wire, and another part of two wires of the same kind, and if the difference of tension in a foot of the single wire be found equal to the difference of tension in two feet of either of the pair, the inference is that each of the latter, which conducts half the quantity of the former, requires half the intensity.

4. To find lengths which have equal differences of tension, two methods may be taken. The one will require a galvanometer having a double coil of two very fine wires of great length, so as to conduct a very small quantity, and still act with conside-

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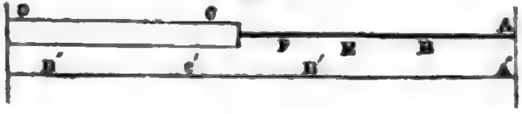
* Becquerel, it appears, entertained the same view of the electric state of a conducting wire, and illustrated it by an experiment of precisely the same kind.

rable power on the needle. Let AD (fig. 1) be a conductor made up of a single wire AC,[*] and several CD. The battery circuit being completed, let the points C and D be connected by one of the wires of the galvanometer. The needle will be powerfully deflected. Now let E and F be connected by the other wire of the galvanometer, but so that the current arising may act in opposition to the former, and let the space EF be increased till the actions on the needle balance each other. Next, let the points A and B be connected by the same wire as C and D before, and AB increased till the needle is stationary. Then AB and CD will have equal differences of tension, for though the galvanometer wire did draw out a small fractional part of the battery current, still it was the same quantity in both cases. EF might be taken instead of AB, if we could be sure the wires of the galvanometer were exactly equal in their actions, and this adjustment might be made without much difficulty.

Fig. 1.



5. A better method, and the one I adopted, is the following. It requires only a galvanometer of the ordinary construction. Let A′D′ be a uniform conducting wire placed alongside of AD, and well connected with it at the extremities. If, while a current is passing, any point of AD be connected through the galvanometer with a point of A′D′, of different tension, the needle will be deflected, but a point may always be found in A′D′, where no deflection will take place. Let A and A′ be points of equal tension ascertained in this manner, as also B and B′, C and C′, and D and D′, and let m represent the number of the wires AC, and n the number of CD. Then, if A′B′ be made equal to C′D′, AB and CD will have equal differences of tension, and according to the first proposition we shall have

$$n \,.\, \mathrm{AB} = m \,.\, \mathrm{CD}.$$

Or if A′B′ and C′D′ be not equal, we may reduce to equal lengths by substituting for the ratio of AB to CD, that of AB . C′D′ to CD . A′B′, and we shall have

$$n \,.\, \mathrm{AB} \,.\, \mathrm{C'D'} = m \,.\, \mathrm{CD} \,.\, \mathrm{A'B'}.$$

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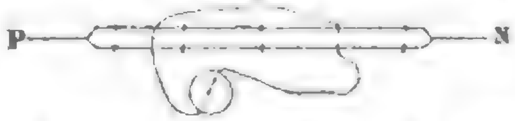
[*] If this method be taken, AC must either be a single wire, or, if several, they must be well joined near as may be to B, A being at the same time taken near the connected extremities; and the same caution must be applied to the common measure EF, unless it be taken on a single wire, introduced for the purpose, so as to convey the whole current. C and D also must be near the connected extremities of the wires.

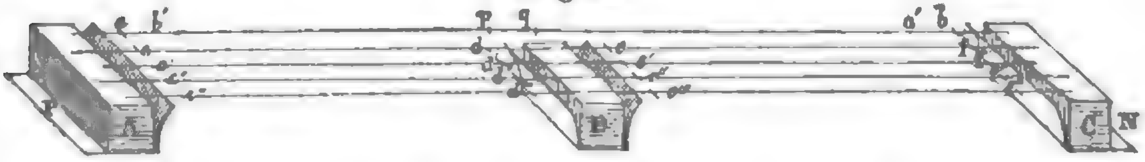
6. A galvanometer for these experiments was formed of two sewing needles, and about twenty turns of No. 31, brass wire, covered with silk. A preliminary experiment was made, to settle the question whether any great inequality of conducting power existed in a metallic wire, it being obvious that such inequality might exist, without being ordinarily apparent. Iron wire of about one twentieth of an inch in diameter was first tried. Two parallel wires were connected at the ends, and made to form part of a galvanic circuit, (fig. 2.) One of these was then divided into several equal parts, and for each of the points of division, a point of equal electric tension was found in the other, by extending a conductor from the point in the first wire through the galvanometer to the second, and passing along the latter till the needle ceased to be deflected. The points thus determined in the second wire, were very nearly equidistant. Brass wire was tried in a similar manner, and with the same result. For the convenient performance of these and the subsequent experiments, two slides were used to move on the conducting wires, carrying in contact with them bits of brass wire crossing at right angles. These latter wires were connected with the galvanometer by metallic ribands, one of which was divided in the middle, so that the connection could be made and broken at pleasure. This was done with wooden handles, to prevent the disturbance which was found to arise from thermo-electricity, if the hand touched the conducting ribands.

Fig. 2.



7. For the course of experiment already indicated, No. 22 brass wire was used. To a piece of board were attached bridges A, B, C, (fig. 3,) and on these were strained several pieces of the wire, as shown in the figure, *ab* being a single wire, which we may call the gauge wire, of near six feet, and matched by four others *cd* of about two feet, and four *ef* of over three feet. These wires were insulated from one another by the dry wood, except when soldered to pieces of sheet copper P, O, N, passing under the bridges. With this arrangement, the experiments could be conveniently varied, by leaving more or less of the wires out of

Fig. 3.



the circuit. The gauge wire ab was, of course, always soldered at a and b, and for the first trial cd and the two ef, $e'f'$, were soldered evenly as possible, and the battery current passed from P to N. Not trusting to the exact equality of electric tension between the points a and c, b, f and f', e and e', at the ends of the copper plates, points of equal tension near them were carefully ascertained by actual experiment, which points we designate still by the same letters. Also points of equal tension p and d, and a point q, of equal tension with e and e'. The result for the length of the several parts was,

(1.) $ap=29{\cdot}93$ inches, $qb=29{\cdot}93$ in. $ef=37{\cdot}98$ in.
$cd=19{\cdot}02$ " $e'f'=37{\cdot}98$ "
Here $2cd : ef$, (§ 5.) $:: 634 : 633$.

Adding the wire $e''f''$ to the previous ones, and taking all the points of equal tension anew, the result was,

(2.) $ap=23{\cdot}48$ in. $qb=23{\cdot}48$ in. $e'f'=38{\cdot}05$ in.
$cd=12{\cdot}71$ " $e''f''=38{\cdot}06$ "
$3cd : ef :: 508 : 507$.

Adding next $e'''f'''$, and proceeding in like manner,

(3.) $ap=47{\cdot}43$ in. $qb=19{\cdot}35$ in. $\left.\begin{matrix} e'f'=38{\cdot}10 \text{ in.} \\ e''f''=38{\cdot}13 \text{ "} \\ e'''f'''=38{\cdot}14 \text{ "} \end{matrix}\right\}$ mean, 38·12.
$cd=23{\cdot}41$ "
$4cd \,.\, qb : 38{\cdot}12 \,.\, ap$, (§ 5.) $:: 465 : 464$.

Comparing in the same way three wires cd, $c'd'$, $c''d''$, with the four ef,

(4.) $ap=29{\cdot}69$ in. $\left.\begin{matrix} c'd'=23{\cdot}19 \text{ in.} \\ c''d''=23{\cdot}21 \text{ "} \end{matrix}\right\}$ mean, 23·20.
$qb=36{\cdot}68$ in. $\left.\begin{matrix} e'f'=38{\cdot}13 \text{ in.} \\ e''f''=38{\cdot}15 \text{ "} \end{matrix}\right\}$ mean, 38·14.
$4qb \,.\, 23{\cdot}20 : 3ap \,.\, 38{\cdot}14 :: 500 : 499$.

8. These results show the approximate truth of our first proposition; but the deviations are observed to be all on one side, and remarkably uniform in magnitude. To ascertain whether this was not owing to a small inequality of conducting power, the experiments were varied by reversing the wire ab, marked now $b'a'$. Comparing cd with ef and $e'f'$, and finding points of equal tension as before, the result was,

(5.) $b'p=35{\cdot}95$ in. $qa'=30{\cdot}07$ in. $ef=38{\cdot}06$ in.
$cd=22{\cdot}91$ " $e'f'=38{\cdot}06$ "
$2cd \,.\, qa' : ef \,.\, b'p :: 144 : 143$.

9. This is a great increase of deviation on the same side, and might be explained by supposing the single wire cd, a better conductor than the wires ef, and also the end a of the gauge wire, better than the end b. This last difference, which must be the smaller, would partly cancel the other in the first experiment, but augment it in this. To ascertain, then, whether superior conducting power in cd had a part in causing the deviations, $c'd'$, $c''d''$, and $c'''d'''$, were successively compared with ef and $e'f'$, ab still retaining the reversed position. The results gave,

With $c'd'$, (6.) $2c'd'.qa' : ef.b'p :: 3260 : 3261$.*
" $c''d''$, (7.) $2c''d''.qa' : ef.b'p :: 398 : 397$.
" $c'''d'''$, (8.) $2c'''d'''.qa' : ef.b'p :: 7500 : 7501$.

10. Granting that the end b of ab is inferior in conducting power to the end a, it would appear by the result of the 6th and 8th, that to compensate nearly this inequality in those cases, $c'd'$ and $c''d''$ are each inferior to the pair ef. If this is so, we ought on restoring the gauge wire to its original position, to have with $c'd'$ and with $c'''d'''$ a large deviation on the side opposite to that of the deviations in the first experiments. Accordingly ab was restored to its first position, and comparing $c'''d'''$ with the pair ef, the result gave,

(9.) $2c'''d'''.qb : ef.ap :: 187 : 188$.
With $c'd'$, (10.) $2c'd'.qb : ef.ap :: 149 : 150$.

11. These two last results, though they do not coincide so exactly as the 6th and 8th would require, still break up the uniformity of the first results, and at the same time, while the disagreement between them does not exceed what might easily arise from error in the measurements taken in them and the 6th and 8th, they give a satisfactory account of any deviations greater than this. So far, then, as these experiments go, they establish the strict truth of our first proposition, that in the same conductor the quantity conducted is as the intensity.†

12. The second proposition would be proved, by showing that each of the parts into which any conductor may be longitudinally divided, conducts its own share of the current, independently of

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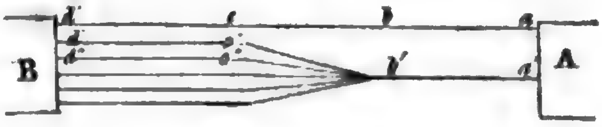
* The measures taken in the experiments of this and the next article, are of the same general magnitude with those of the 5th experiment, and are therefore omitted.

† In all the foregoing experiments, except the preliminary ones, a single pair of Smee's battery was used.

the rest, i. e. that its conducting power is not affected by any action, either of the adjacent metal as such, or of the current existing in it. This was tried rudely in the following manner. Five brass wires, No. 26, $a'b'c'd'$, (fig. 4,) having their extremities, in common with those of the gauge wire $abcd$, soldered to sheets of tin plate, were bound into a bundle from a' to b', and separated to a little distance through the remainder of their length. The current being passed between A and B, and points of equal tension a and a', &c. taken, the result was,

Fig. 4.



$ab = 25{\cdot}455$ in. $cd = 26{\cdot}080$ in.

$a'b' = 25{\cdot}436$ " Mean of the five $c'd'$, $c''d''$, &c. $= 26{\cdot}187$ "

$a'b' . cd : c'd' . ab :: 205 : 206.$

The discrepancy is certainly within the possible limits of unequal conduction in the wires, and the result shows that the wires in the bundle do not mutually interfere with each other's conducting power. This accords with the result of a different experiment of Prof. Faraday, from which he concludes "that collateral currents, either in the same or in opposite directions, exert no permanent inducing power on each other, affecting their quantity or tension."* The inclination of the wires between b' and c', c'', &c. is almost exactly compensated by averaging the lengths of $c'd'$, $c''d''$, &c. A more elegant form of experiment would be to compare one part of a wire extended, with the remainder in coil, but we should lose the condition of actual contact between the adjacent wires.

13. The obvious method, however, of deciding the truth of the proposition now under consideration, is to compare two solid conductors of different sections. Wires would not answer, on account of the probable difference of texture in different sizes. Rods of wrought metal of the same size and quality, might be cut and ground down to different sizes without disturbing the texture, taking care to remove the whole exterior portion. Extreme uniformity of section in the conductor would be unnecessary, if the true average be taken by weighing the identical part concerned in the experiment. But having no means to perform

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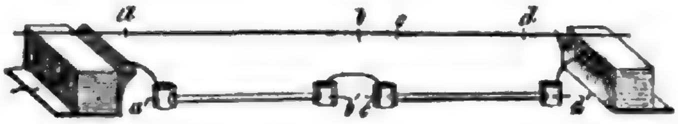
* Experimental Researches, vol. i, p. 6.

such operations, I have only made a single experiment with partially purified mercury in glass tubes. The arrangement is shown in fig. 5. *abcd* the gauge wire used as before, $a'b'$ and $c'd'$ the tubes of mercury, terminated by wooden cups, and the whole connected together as shown in the figure. The cups were pierced with brass pins a', b', c', d', reaching almost to the extremities of the tubes,* and varnished within the cups, except at the points, where the varnish was ground off. On passing a current between P and N, it would be divided between the gauge wire and the tubes of mercury, and the tension at the extremities of the latter could be ascertained by severally connecting the pins a', b', c', d', through the galvanometer, with the corresponding points of equal tension a, b, c, d, on the former. With a single pair of Smee's battery, in imperfect order and weakly charged, the result was,

Fig. 5.



$ab=45·619$ in. $cd=15·825$ in.

Tube $a'b'=20·050$ " Tube $c'd'=15·097$ "

Weight of mercury in tube $a'b'=14·095$ grammes.

" " " $c'd'=23·004$ "

Let $ab=\mathrm{L}$, $a'b'=l$, weight of $a'b'=w$, and section of $a'b'=\frac{w}{l}$,

$cd=\mathrm{L}'$, $c'd'=l'$, weight of $c'd'=w'$, and section of $c'd'=\frac{w'}{l'}$.

Then if we adopt the first proposition, and assume the second which is to be proved, ab, which of course varies directly as the length of $a'b'$, must vary inversely as its section, or L varies as $\frac{l}{\frac{w}{l}}=\frac{l^2}{w}$, or $\mathrm{L}w$ is as l^2; i.e. $\mathrm{L}w : \mathrm{L}'w' :: l^2 : l'^2$, and $l'^2\mathrm{L}w=l^2\mathrm{L}'w'$.

Now in the above experiment we shall find that

$$l'^2\mathrm{L}w : l^2\mathrm{L}'w' :: 705 : 704.$$

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* A minute space was left between the end of the tube and point of the pin, on account of the obstruction of the current by the latter. For a very accurate experiment, it would be better to pass the pin through the side of the tube, at a little distance from the end. It may be worth while to state, that at first very fine sewing needles were used in place of the pins, and with these none but a strong current would pass to the galvanometer. No attempt was made to amalgamate the steel points, but the brass pins were substituted at the suggestion of a friend, to whose kindness I am much indebted.

14. A weak current was purposely used to avoid generating, as far as practicable, unequal heat in the mercury cylinders, lest the conducting power of the two should be unequally affected. What degree of heat might have been generated, could not be ascertained in any of my experiments, but it was never sensible to the touch, though sometimes it appeared to be indicated by thermo-electric action, (§ 18.) The last experiment was repeated with two pairs of plates, though not with a very strong charge, and the result gave

$$l'^2 \mathrm{L} w : l^2 \mathrm{L}' w' :: 586 : 585.$$

Thus we have good evidence of the truth of our second proposition. It might seem at first sight that the whole law, including both the propositions, was proved by this experiment alone, but it will be readily seen that this is not necessarily true. The supposition, for instance, that in a given conductor the quantity is as the square root of the intensity, and in different conductors as the square root of the section, would explain as well as any other the result of the above experiment. It cannot, therefore, positively demonstrate one of the two propositions without the aid of the other, though it would certainly afford a strong probable support to both, and on this presumption, strengthened by these results with the *metals*, I may perhaps rest in the experiments I propose to make on conducting *fluids*, (§ 16.)

15. Any one in a situation to make accurate experiments, will find it easy to examine this law in the manner here described, with a degree of precision very far exceeding what I have attained. Conductors of very fine and uniform texture appear to be the principal desideratum. If these can be made perfect, I think that with a good galvanometer and considerable length of conductor, results may be obtained approaching even the exactness of geometrical measurements, and that an exceedingly minute deviation from the law, may, if it exist, be detected. Even if conductors cannot be made absolutely uniform, the corrections that ought to be applied to them, can be ascertained beforehand by comparing them with many other similar conductors, and taking a mean of the results. Should circumstances permit, I shall pursue the subject further hereafter, unless the occasion for doing so should be superseded.

16. The experiments I have described still leave room for doubt as to the application of the law in question to the case of

electrolytic conductors. On account of the peculiar relation of these bodies to metallic conductors, it is impossible to apply to them the same form of experiment that I have used with the metals. I have however set on foot such modified forms of experiment as my means will allow, but cannot complete them in time for this paper. Their success is doubtful on account of inherent difficulties, but if successful they may be communicated on some future occasion.*

17. A similar method of experiment to the above may be employed for the exact determination of the conducting power of metals, as also the variation of their conducting power with variations of temperature, and the general law, if any, which governs such variation, and other particulars. I have made a few experiments on conducting powers, but there was nothing of importance new in the results. A statement, however, made in this Journal† a few years since, that the conducting power of a wire was greatly impaired by bending or twisting it, was not confirmed. After winding and unwinding a thick wire several times over a cylinder less than an inch in diameter, the conducting power appeared scarcely affected, either in iron or brass wire.‡ So the annealing a hard iron wire at a low red heat affected its conducting power very little.

18. In the preliminary experiment on the uniformity of conduction in wire, the interference of thermo-electricity with the legitimate indications of the galvanometer was soon manifest. Such precautions however were taken, that in all the subsequent experiments no indications, or but doubtful ones, of thermo-electric action were perceived *when the battery was not in action.* But when the battery current was flowing, the indications of the galvanometer were subject to fluctuations, as if the points of equal tension were not quite stationary. These fluctuations, though confined within very narrow limits, and by no means sufficient to affect materially the results, were still manifest, and were as great near the soldered extremities of the wires as in the middle parts. They may therefore be referred to variable thermo-electric action between the wires and solder, in consequence of heat

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* One of these experiments has been made since this was written, and the law found to hold in the case of dilute acid.

† See this Journal, first series, vol. xxxv, p. 109.

‡ A copper wire gave the same result, but it had been previously bent.

excited by the current. This was shown by doubling a wire so as to form two conductors joined at one end without solder, in which case the fluctuations disappeared at that end. This thermo-electric action, if constant, would not, however great, affect the accuracy of the experiment.

19. It is important to remember that the above law cannot, according to the present state of our knowledge, be generally applied to the case of momentary currents, such as the Leyden discharge, or the spark from the prime conductor of an electric machine, or induced currents at the making or breaking of a galvanic circuit. In such cases the induction of electric currents on themselves must interfere. If however we assume that at a constant distance the force of induction in a given length is proportional to the rate of increase or diminution of the current,* it will follow that two conductors of the same section but different lengths, will divide an electric discharge between them in the inverse ratio of their lengths, and in this case no error will be involved in the application of the law. But when we come to vary the section, it would probably be found to fail, the smaller section having the advantage. Or if the form only of the section were varied, in which case the advantage would probably be in favor of that which departed most from a circle.

20. The inquiry might arise whether these things should not be taken in view, in considering the theory of the discharges through telegraphic wires. The question in this case is whether the inductive action of the current on itself may not in those very long wires so much retard its increase as to prevent its assuming its maximum quantity during the time of a discharge by the key. Now if the assumption already made (§ 19) be true, it will follow that in a conductor of given section and conducting power, the time in which the current will reach its maximum under a constant electro-motive force will be independent, not only of the length of the conductor, but of the motive force itself. Indeed in mathematical strictness, the current would never reach its maximum under a constant motive force, but

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* Prof. Henry, as is well known, supposes the induction of an electric current to last during its increase or diminution, and to be stronger as the increase or diminution is more rapid. His valuable papers on this subject may be found in volumes xxxviii and xli, of the first series of this Journal. See also Faraday's Researches, vol. i, p. 2.

would increase by increments forming in equal successive intervals of time, a descending geometrical progression,* of which the common ratio would be determined by the section and conducting power of the wire. If this is so, the induction of currents on themselves will no more interfere with the application of the law of conduction to the case of discharges through the telegraphic wires, than through the shorter conductors in ordinary experiments, and we may presume therefore that the effect of this induction is not appreciable in telegraphic discharges.

21. If in the register of Morse's telegraph the wire in the coil of the electro-magnet be supposed always to occupy the same space, and to be of constant weight, then according to Lenz's law the maximum effect on the electro-magnet ought to be obtained when the length and section of the wire of the coil are such as to make its resistance to conduction equal to that of the wire between the stations; and if this adjustment of the register to the distance of the stations could always be made, the intensity of battery required to work it ought to be, not as the distance itself, but as the square root of that distance. If it be found that the inductive reaction of the electro-magnet on the current prevents the latter from reaching its maximum during the period of discharge, the advantageous length of the wire of the coil would be less and its section greater than as determined by the above rule. It would still remain true, however, according to theory, that if the intensity of the battery varies as the square root of the distance, and the resistance to conduction of the wire of the coil have a constant ratio to that of the wire between the stations, the space of time in which the current will attain any given fractional part of its maximum, and the magnetic force developed in that time, will always be the same.

Yale College, January, 1846.

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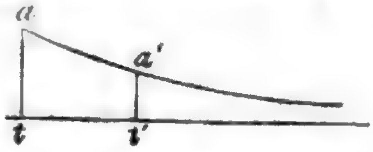
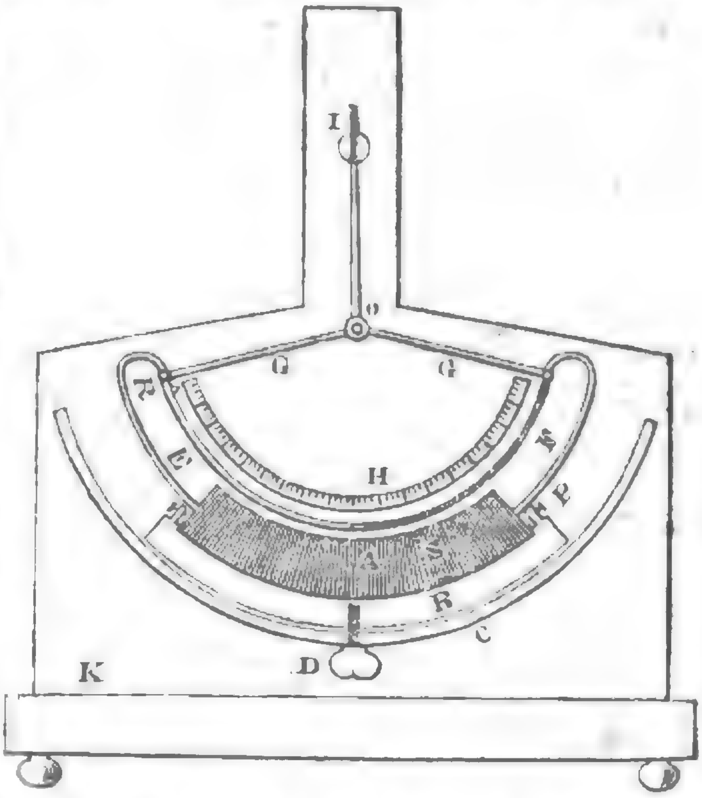
[*] This is strictly affirmed only with respect to a conductor in the form of a thin hollow cylinder. The law of increase in such a conductor may be shown by the logarithmic curve aa'. If time be represented by motion along the line tt', and if t represent the point of time at which the current begins, the space $tt'\,aa'$ may represent the quantity of the current at a point of time represented by t'. In a solid conductor this law must be a little modified, the increase of current being at first more and afterwards less rapid at the surface than in the central parts. But this does not affect the truth of the other facts stated.



ART. XI.—*Axial Galvanometer*; by CHARLES G. PAGE, M. D., Prof. Chem. and Pharm., Columb. Coll., Washington, D. C.

THE Galvanometer or Galvanoscope, as usually constructed, I have before stated is far from being a reliable instrument, for several distinct reasons. First, if the needle is not of the hardest steel, its power is constantly varying, under the influence of varying currents in the coil of wires. The magnetic force of the needle tends constantly to diminish, and the action of a powerful current is to give it an extra charge, and should its position be accidentally reversed, that is, be the reverse of that which it would assume under the action of the current, its polarity will be reversed, or its force much weakened. Any variation in the force of the needle during the course of investigation, must necessarily be productive of error in the results. Again, it is exceedingly difficult to render a needle perfectly astatic, or to divest it of local influences when the single needle is used. Again, in operating with high galvanic powers, the differences of deflection are almost imperceptible, and the estimates become exceedingly complicated. By substituting for the magnetized needle, a wire of soft iron, we gain in several particulars. First, the wire has no magnetic power, above that which is due to the retentive power of the soft iron, which may be considered as nearly a constant quantity. Second, the deflective force is not called into action, and therefore the observations are not complicated by fluctuations in the earth's action, or local forces. In using the galvanometer ordinarily, the degree of deflection is the difference between the earth's action, or the compound ratio of the earth's action and a local magnet, and the action of the galvanic current, or else the difference between the deflective force of the current upon an anastatic needle and the force of torsion. The axial galvanometer is sufficiently sensitive for most persons, is more delicate than I had anticipated, and it has the advantage of being rendered more or less sensitive at pleasure. In Vol. XLIX, p. 137, of the former series of this Journal, I gave an account of an axial galvanometer, in which it was necessary to use the spring balance to determine by weight the amount of forces. In the instrument now presented this difficulty is obviated, and the iron wire within the coil constitutes the balance itself. In the first form, the use of the spring or lever balance involved much friction and unstableness. In the representation, the parts are of very different proportions from those of the instrument in actual use; the object of making the curves of such short radii being to contract the drawing. The coil of copper wire A is made upon a circular former, consisting of a bent rod about one fourth of an inch in diameter. The piece of soft iron wire E is less than one eighth of an inch in diameter, and is bent so as to be concentric with the coil. It is counterpoised by a brass wire F of similar form, and extending about half through the coil, the dividing line being shown half way. The soft iron wire should be of greater length than the coil, so that when the bend of the wire at R is in contact with the extremity of the coil, its ends should project some distance from the opposite extremity.



The extremities of the coil of wire are connected with binding screws P. The index point R shows upon the scale H the degree of force exerted, in absolute weight. The frame of soft iron and brass wires is braced and suspended by the wire rods G, G, the whole moving freely upon the centre O. Above this is raised a stem with a regulating weight, by which the sensitiveness of the instrument may be increased or diminished at pleasure. The coil is firmly secured to a concentric bed-piece or block B, which slides upon a concentric shelf or projection C, and is fixed at any desired point by means of the set screw D, passing through a slit in the shelf C. By moving the coil back or forth upon the slide, the sensitiveness of the instrument may also be diminished or increased at pleasure. The position of equilibrium between the coil and wire, is when the bend R of the wire is in contact with the coil, but the point of greatest action is when the extremities of the wire about coincide with the dotted line S. Therefore if the coil be so adjusted that this line shall be under the dividing line in the centre of the frame, the sensitiveness is at a maximum.

The capabilities of this instrument are obvious, and if the wire of the coil be fine and of considerable length, we are enabled to determine in a ready manner the relative powers of different orders of currents, and numbers of elements in the compound batteries. The power of the instrument may be much increased, by inserting the branch of the soft iron which is now without the coil, in another similar coil, but the construction would be a little more complicated. The two branches of the wire frame may be so put together as to be easily separable, for the introduction and trial of coils of various dimensions and sizes of wire; in which case the coils should all be made upon the same former, so as to present the same diameter of central opening.

Washington, January 16, 1846.

Art. XII.—*Remarks on some Fossil Bones recently brought to New Orleans from Tennessee and from Texas;* by William M. Carpenter, M. D., Prof. in the Med. Coll. of Louisiana.

I. *Fossils from Tennessee—the "gigantic Fossil Man,"* (being the skeleton of a young mastodon.) Much interest has been recently excited by the announcement of the discovery in Tennessee of the remains of a man eighteen feet high. The papers teemed with accounts of the prodigy, and public confidence was secured by the assertion that the distinguished physicians of the west had testified that they were human remains. About the last of December these remains reached this city; and on the first of January I was requested by a distinguished surgeon here to go with him on the invitation of the proprietor to examine them, and give an opinion. They had been erected in a high room; the skeleton was sustained in its erect position by a large upright beam of timber. At a glance it was apparent that it was nothing more than the skeleton of a young *mastodon*, (one of Godman's Tetracaulodons, with sockets for four tusks.) The bones of the leg and ankle were complete, the metatarsal bones wanting. The bones of the anterior extremities complete to the metacarpal bones, which were present in one leg, the phalanges wanting. Most of the vertebræ were present; the ribs mostly of wood. The pelvic arrangement was entirely of wood; the scapulæ were present, but somewhat broken, and were rigged on with a most human-like elevation; pieces of ribs supplying the want of clavicles. The osseous parts of the head were portions, nearly complete, of the upper and lower jaws. Some of the molars were quite complete; of the tusks, only one little stump remained, but the four alveoli of the upper jaw had large incisive looking wooden teeth fitted into them, and the lower jaw supplied to correspond. The cranium was entirely wanting from the lower margin of the orbits, back; but a raw-hide cranium was fitted on, which was much more becoming to the animal in his new capacity than the old one would have been.

The artificial construction was principally in the pelvis and head; and take it as thus built up, with its half human, half beast-like look, and its great hooked incisive teeth, it certainly must have conveyed to the ignorant spectator a most horrible idea of a hideous, diabolical giant, of which he no doubt dreamed for months. To one informed in such matters it really presented a most ludicrous figure.

The person who had it for exhibition was honest, I believe, in his convictions as to its being the remains of a man, having been confirmed in them by numerous physicians, whose certificates he had in his possession; and having asked and received my opinion, he determined to box it up, never to be exhibited again as the remains of a human being.

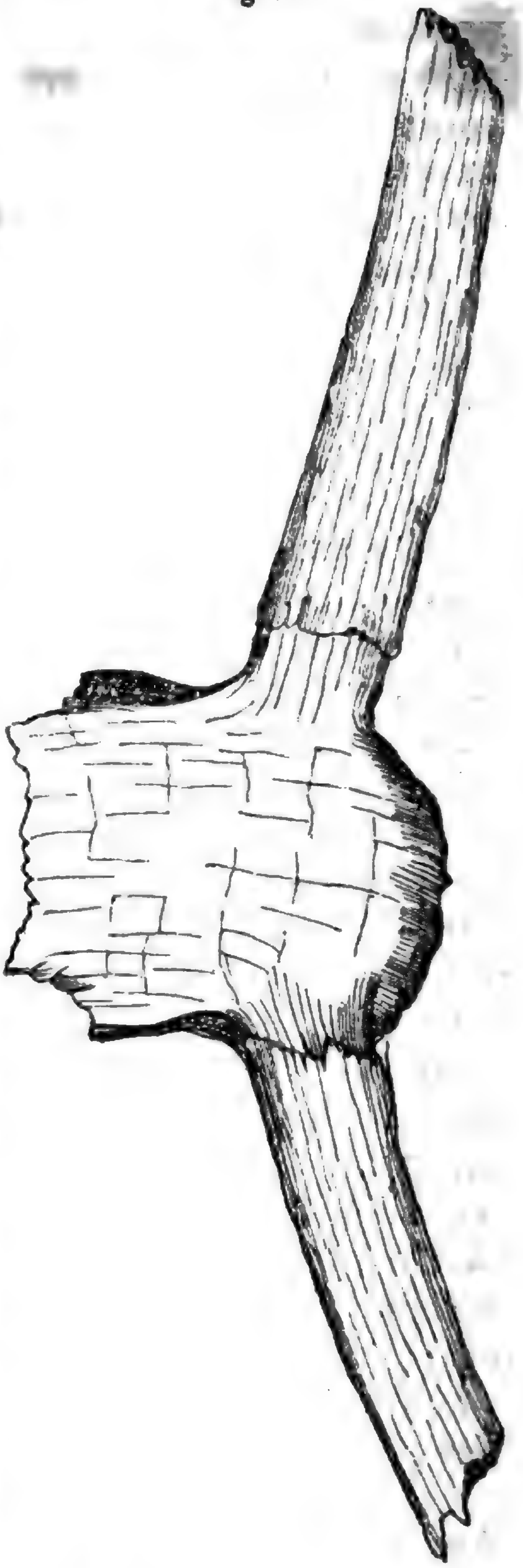
II. *Fossils from Texas.*—These fossils were collected by Mr. Wm. Huff from the banks of the Brassos river, near San Fillippe, I believe. They are now exhibiting in Mr. Cook's gallery of paintings in this city. Mr. Huff has been a resident of Texas since his boyhood, and has in the wild region of the western part of that state, acquired an ardent passion for the collection and study of fossils. By his kindness I have been permitted to make the following notes and drawings from his specimens. The fossils were all found in the same formation, which seems to have been a mixed clay, sand and gravel, with much iron.

1. *Fossil Ox.*—This specimen consists of the frontal bone, with portions of the bony nuclei of the horns. The frontal portion of the orbit of one eye is nearly entire; the margins of the other are broken. None of the bones of the lower portions of the head are left, being replaced by a conglomerate mass of sand and pebbles. The whole specimen is colored by oxide of iron, and a scaly incrustation of the same covers the frontal bone, except where the parts have cleaved off. The horns are similarly

colored, and the under side of each is encrusted with a hard ferruginous crust, in which quartzy pebbles are imbedded.

Fig. 1 represents this specimen, $\frac{1}{16}$th its linear dimensions. From tip to tip of the broken horns measures 56 inches; the right being 2 feet, and the left 18 inches long; the circumference of the nucleus of the horns at base is 17 inches, and at the distance of 18 inches from the head the circumference is 14½ inches. The frontal bone between the horns is 14 inches in breadth; between the external angles of the orbits 14¾ inches; between the internal angles of the orbits 11½ inches; and the length of the bone from the orbital to the occipital portion is 15 inches. The bones of the horns are nearly round, and they have a slight curvature upwards and forwards; and when entire, the bony parts must have measured, at a reasonable estimate, about 4 feet; and allowing the increase in length by the addition of the horny parts to have been only a foot, it would give a probable distance between the tips of the horns to be at least 11 feet.

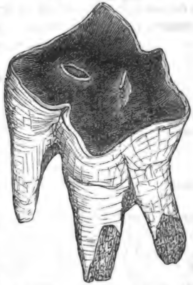
Fig. 1.



The frontal bone is nearly plane anteriorly, and the horns arise laterally from a level with this plane; but the bone bulges about 2½ inches in the occipital portion above the horns, as shown in the figure.

Fig. 2 represents a tooth found with the head described above, but not attached to it, as the jaw bones were wanting. It is

Fig. 2—natural size.



the second true molar of the left upper jaw, (the fifth if the false molars are counted.) It deviates in some unimportant points from the ordinary form of this molar in the ox family. Its crown is much worn, and the internal segments of enamel are very small; in the anterior half, the segment is of an elongated oval form, while in the posterior half, the segment of enamel projects up in the form of a little crescent-shaped cutting edge, as I have endeavored to show in the sketch. In its greatest length the crown is 1·6 inches; and in its greatest breadth 1·2 inches.

The characters and dimensions of this tooth, and the fact of its having been found with the head, renders it almost certain that they belonged to the same individual, which was of gigantic size.

2. *Fossil Tapir.*—Previous to the year 1842, no undoubted fossil remains of the tapir had been described. Cuvier* described remains resembling those of the tapir family in the structure of the teeth; and his Lophiodon seems to have been a closely allied genus. In this country, remains have been described resembling those of the tapir, and have received the name of Tapiroid fossils.† In 1842 I described and figured‡ a tooth found in digging a well in the prairies near Opelousas, in this state. There could not arise a doubt that this tooth belonged to a tapir. Among the fossils brought from Texas by Mr. Huff, there are parts of both the upper and lower jaws of the same species as that found at Opelousas, and these have enabled me to confirm positively the opinion then advanced, that the tooth described was the fifth molar of the left lower jaw.

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* Ossemens Fossiles, vol. ii, p. 163, *et seq.*

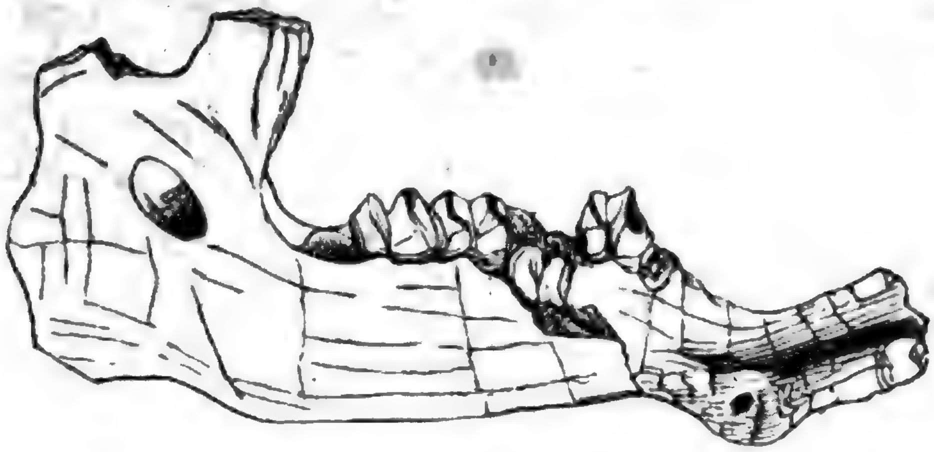
† Geological Transactions.

‡ American Journal of Science and Arts, vol. xlii, p. 390.

The following figures represent the specimens from Texas.

Fig. 3 represents the left half of the lower jaw, nearly complete. A portion of the posterior margin of the ascending branch is broken off; the condyle is broken off, but the process in part remains; the posterior molar is wanting; the third molar is with the jaw, but is loose, and being a deciduous tooth, was taken off in making the drawing, to show a young tooth which is growing up under it to replace it. There is a canine tooth on each side. Of the incisive teeth none remain, and the sockets of only the four middle ones can be seen, though it is probable that the two small lateral ones were present. The total number then would be six molars, one canine, and three incisive teeth on each side, making a total of twenty.

Fig. 3—one third the natural size.



The presence of the canine teeth, the full number and replacement of the molars, show that the animal was just attaining to the adult age. All of the molars are considerably worn excepting the posterior one. That lying over the new one which was growing up, was very much worn.

The proportions and size of this jaw agree perfectly with those of the American tapir, as is shown by the following comparison between the measurements in the American, the present fossil, and the Indian tapir. The measurements are in inches and tenths of an inch. The measurements of the American and Sumatra tapirs are from Cuvier.*

	American Tapir.	Fossil Tapir from Texas.	Tapir of Sumatra.
Length of the lower jaw, from the posterior part of the condyle to the margins of the incisive teeth, ...	11·0	11·0	13·7
Length from the posterior margin of the ascending branch of the lower jaw to the edges of the incisive teeth, . .	12·0	11·8	15·2

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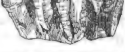
* Ossemens Fossiles, vol. ii, p. 159.

As the incisive teeth, the condyle, and posterior margin of the ascending branch, are wanting in the Texas specimen, the measurement is only approximative; but there cannot be much error, as the data are sufficient to give a very certain result.

Fig. 4 represents the part of a left half of the upper jaw of a tapir, perhaps of the same individual, as the specimens were found within a few feet of each other. The teeth are represented from the inner side. They are the four posterior molars. On the outer side of the specimen, and arising from a point corresponding with the point of juncture of the two last molars, there remains a portion of the zygomatic arch. The two anterior molars are considerably worn, the third less so, and the posterior one not at all.

Fig. 4—¼th size, lineally.*



3. Among the bones of this collection, are numerous fragmentary specimens of the bones of the mastodon and elephant. Those of the elephant, particularly of the teeth, are much more numerous than those of the mastodon.† There is one tusk of a mastodon which measures eleven feet in length, and twenty six inches in circumference in its largest part. It has a double curvature.

4. There are two claw-bones of one of the Megatherideæ, perhaps of the Oryctotherium?

5. There is likewise a very imperfect fragment of a skull, of very solid, hard, and heavy bone, which has been thick, and of a large cellular structure, especially at the occipital part of the head. The foramen magnum and condyles have been perpendicular to the basal bone, and to the direction of the base of the brain and the spinal column. The remains of the frontal portion of the head makes a large angle (perhaps 30°) with the basal bone. There is a well developed petrous bone on the right side of the head, the opposite one being wanting. The brain had numerous convolutions, as shown by the marks in the skull. The bone is perhaps thirteen or fourteen inches in length, and the cranial cavity would perhaps contain a quart. This cavity is of an oval shape, but narrowing rapidly forward. I can form no accurate

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* Fig. 3, with which fig. 4 corresponds, is incorrectly printed one third, instead of one fourth, the natural size.

† I have remarked the same predominance of the elephant over the mastodon remains in collections made in Missouri.

idea of what it belonged to, but my impression is that it was some of the Cetacea. But to this opinion the objection may be offered that in the Cetacea the petrous bone is not fixed by bony union, as in this case. To the opinion that it might have been a small elephant, the objection occurred to me that in them the cranial cavity is as broad as it is long; and then again the cellular structure of the bone does not extend over the whole cranium as in the elephant, but is mainly limited to the posterior part above the back part of the cranial cavity.

Another curious specimen is a bone that appears to be part of a jaw bone, with small parts of the two rami. That is, it is the part in which the two bones met. It is concave on what I will call the inner side, and has a smooth, concave groove above. The front or chin portion is much broken, but contains two holes which appear to have been sockets for tusks. The fragment is about seven inches in each of its dimensions. The two sockets or holes are one inch and three fourths in diameter, perfectly straight, having the appearance of being drilled out, and about four inches deep; though they were much deeper before the other parts had been broken off. This I cannot refer to any known fossil species, unless it may have belonged to Dinotherium, or some such genus. The bone is light and friable.

New Orleans, La., January 14, 1846.

Art. XIII.—*Sequel to the Vestiges of Creation.*[*]

In the few remarks upon the Vestiges which follow, we do not attempt to pursue the author through all the windings into which he has been led by the use of "the function of hypothesis."[†] The work has been so generally read, and so frequently reviewed in journals of all kinds, and with arguments so various, that we throw out only a few thoughts; and this, not in the way of denunciation, a style which has unworthily characterized some reviews, nor with the fear of truth that shows itself in many (not all) theological periodicals. The mind of man was put in action by the same being that set the universe in motion, and sooner or later, to the extent of the mind's capabilities, truth will out. It becomes none who have faith in the revealed Word of God, to view science with a distrustful eye; they should rather unite their energies in its promotion.

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[*] Explanations: Sequel to the Vestiges of Creation, by the Author of the same. American edition. Wiley & Putnam, 1846.

[†] Sequel to the Vestiges, p. 127.

Facts most surprising are daily coming to light, gradually widening our field of vision. The mysteries of one day are resolved into commonplace truths the next. The study of Nature, by direct observation, is thus preparing us for nearer and more glorious views of the great system of creation, and more exalted conceptions of its Author. Should the theory of the writer of the Vestiges be finally established, faith and religion would still stand immovable, supported by reason as well as the inspired Word. We may, however, reasonably doubt the speculations of a writer who denies the judgment of science, and endeavors by specious argument to withdraw himself from such a tribunal.*

The Sequel to the Vestiges reviews the ground passed over in the previous work, replying to the objections of its opponents, admitting some difficulties, and setting aside others. The style is fair and candid, and the subject is very skillfully managed. After some remarks on the nebular theory, the author proceeds to establish, by farther arguments and facts, the main point in his hypothesis; that there has been a progressive origin of the species, both in the animal and vegetable kingdoms; in other words, that the higher species in the scale of life, proceeded from those below by gradual development. The gradation observed among organic remains in the rocks of successive ages, is the grand fact appealed to.

That such a gradation may to some extent be perceived, is a fact generally admitted by geologists. Observations however do not bring to light the transition steps which the hypothesis demands. They indicate simply that at different periods, the orders of plants and animals were of a character fitted for the various conditions of the globe; and that as the earth was prepared for the higher orders, they appeared successively upon it. Of those orders which existed during the earlier periods, the species are often the most perfect which the history of organic life presents; and we even perceive in some instances a higher development, and more widely varied characters, than at the present time, as if to compensate by this mode of variation, for the small variety of distinct types and forms. Thus at one period, ferns predominated, to a large extent, over other forest trees; and the lizards of early times were less restricted in their habits, size, and specific characters, than those of the present era. The simple truth appears to be, that there was, as above stated, a general relation between the condition of the world and its productions, such animals living as were adapted to the peculiar temperature of the globe, the nature of its atmosphere and waters, and the disposition of the land.

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* Sequel, pp. 123—127. "It must be before another tribunal that this new philosophy is to be truly and righteously judged."

Admitting the facts as brought forward by the Vestiges and its Sequel, nothing more than the above conclusion, could with propriety be deduced. Such a relation affords no evidence that the animals of one period originated from those of a preceding, by gradual improvement. This is one of those leaps in logic, especially favored by a large development of "the function of hypothesis." The author shows no necessary connection between the premises and his conclusions. Geology, if its facts mean any thing, fully shows that tribes of animals have successively disappeared, owing to physical causes; and that the new races have appeared by creation, and not by gradation, or "progress."

The *Acarus Crossii* is the basis upon which much of the argument in the Vestiges rests; and in the Sequel, the author has offered new evidence with regard to its galvanic origin. Acknowledging the fact, it proves too much. We have here an animal of the class Articulata, far above the infusoria and simple polyps in organization, produced by galvanism, without a gradual development successively through the lower grades. And if the germ of an Acarus may be thus made, without such a gradation of changes, why may not the germ of a mollusc, or of an insect, of a crab, fish or reptile? The germ in each case is a simple minute cellule, and certain favorable circumstances are all that is required for its development. Admitting this instance of galvanic creation, it might with more reason be argued that the germs in all instances were made by direct processes in nature, having been originated by the peculiar electrical conditions of the earth or other unknown circumstances. Such a theory would be a more correct deduction from the alleged fact; and it avoids the objection that the necessary shades of transitions between the gradating species are not to be found represented in the rocks—as for instance, between the birds and kangaroos, fishes and reptiles. We look in vain among the greatest variations of species at the present time for any approximation to such an amount of change, and the trifling modifications detected, only surprise us at the small limits of variation. But we leave the *Acarus Crossii* and the theory it supports, to those who can believe in it.

If we mistake not, there is in the very nature of animal and vegetable life, evidence against the "theory of progress." An animal is a piece of mechanism of divine origin. As in the mechanisms of art, mechanical power is one result of its peculiar construction, which is exhibited through the thousand levers that may be set at work. Besides, there are chemical compositions and decompositions going on in every part, as another result of the powers within, or the battery of forces in action. By these means, the growth or sustentation of the animal takes place, and its physical energies are made manifest. But in addition to the compositions or reproductions going on throughout the system, there is another necessary result of its constitution, which is the reproduction of itself, or of germs equivalent to the same. This result is far beyond that of other reproductions in the system. In the latter, only cellular tissue, or muscular tissue, or some less highly organized animal product, is concerned. But here, all the elements of the parent are engaged, the nervous, cellular and muscular, to bring out a result equivalent to the parent. This reproduction is a consequence of the mechanism, and may be considered as, physically, its prime result; the animal forces within appear to have their point or points of concentration, and the same are the point or points of germ production.

Viewing an animal as thus constituted, have we any reason for believing that it can produce a result superior to, or essentially different from, itself? Its reproductions must be limited to the extent of its powers. It may give origin to mechanisms inferior to itself, as the reproduction of muscular fibre exemplifies; and perhaps the Entozoa (intestinal worms) may thus proceed through certain modifications. But can it accomplish a result beyond its energies? How can a baboon originate any thing above a baboon, with only a baboon's mechanism. The complete concentration of reproductive force takes place only in animals with a highly developed nervous system. As we descend in the scale, the centres multiply, till in the lowest grades, with little but cellular tissue in their constitution, the possible centres are extremely numerous, and the ova as numerous. Throughout we find the proposition supported, that an animal cannot produce an animal of higher powers than itself.* These views, although not yet admitted among established facts, may lead us at least to look with much suspicion upon the "progress" theory of creation.

The Vestiges, notwithstanding some errors, has been, and will continue to be, of incalculable value to science and general knowledge. It has aroused the minds of the many indifferent to scientific investigation, to a spirit of inquiry and research, thus hastening the final establishment of truth.

SCIENTIFIC INTELLIGENCE.

I. CHEMISTRY.

1. *On the Chemical Changes produced by the Action of the Solar Rays, or Actino-Chemistry;* by ROBERT HUNT, (Lon. and Ed. Phil. Mag., July, 1845, p. 25, and October, 1845, p. 276.)—At a meeting of the British Association at York, it was proposed by Sir John Herschel, that all those phenomena, which exhibit change of condition under the influence of the solar rays, should be distinguished, as forming a peculiar province of chemistry, and be designated by the term Actino-chemistry; this was generally approved by the chemical section.

Accordingly, the sun's rays are divided into those producing light, those producing heat, and those producing an *actinic* influence.

Mr. Hunt, in his experiments, confirms a fact first pointed out by Sir John Herschel, that the rays of the sun facilitate precipitation.

A solution of manganate of potash having been made in the dark, was placed in two glasses and set aside. After having been kept in darkness for two hours, the solutions remained as clear as at first. One of the vessels with its contents was then removed into the sunshine, when the solution immediately became cloudy, and was very speedily decomposed, the precipitate falling heavily. By experiments with the spectrum, the author found that the precipitation was due almost entirely to the most refrangible rays.

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* It has been urged against the equivocal generation of Entozoa, that the production of the large ovaries they contain, were a waste of creative power, if the animals may be produced without the intervention of ova. Although not believing in their equivocal origin, we may express a doubt with regard to the validity of this argument. For the production of germs, if the above views be correct, is a necessary result of the animal mechanism; and their vast number is a consequence of the low order of the animal. The theory merely hinted at above, is drawn out at some length in Mr. Dana's work on Zoophytes, in a chapter treating of the growth of Zoophytes and of organic development in general.

A few grains of sulphate of the protoxide of iron were dissolved in rain water; if kept in perfect darkness, the solution remained clear for a long time; it became, however, eventually cloudy and colored from the formation of some peroxide of iron, even in tubes hermetically sealed. A few minutes' exposure to the sunshine is sufficient to produce this change, and the oxide formed, instead of floating in the liquid, and as in the former case rendering it opaque, falls speedily to the bottom.

Mr. Hunt made some experiments, (particularly one with a mixture of the bichromate of potash and the sulphate of copper,) in which precipitation appears retarded by solar agency, and he is inclined to think that it will eventually be proved that the electric energy of the different bodies in relation to each other, will greatly modify the results obtained in these experiments.

The action of the sun's rays appears also to affect the color of the precipitates. If a solution of bichromate of potash is exposed to sunshine, it acquires a property of precipitating several metals as chromates, differing many shades in color from the colors produced by a solution similarly prepared and kept in the dark. If the actinized solution (solution exposed to sunshine) be poured into a solution of nitrate of silver, the chromate of silver formed is of a much more beautiful color than that given by a solution which has not been exposed to the sun's rays. The same is true when the salts of mercury are used.

Solutions of sulphate of iron exposed to sunshine, yield a Prussian blue, with the ferrocyanide of potassium, of a far more beautiful color than that produced by a solution which has not been so exposed.

Among other curious actions that the sun's rays exert, is the one by which it prevents electro-metallic precipitation. Place in a test tube a strong solution of nitrate of silver; in another tube, closed at one end by a thin piece of bladder, place a solution of iodide of potassium; this is supported in the solution of nitrate of silver by being fixed in a cork, and a piece of platinum wire is carried from one solution into the other. An arrangement of this kind being kept in the dark, iodine is soon liberated in the inner tube, and a crystalline arrangement of metallic silver is formed around the platinum one, in the outer. Another being placed in the sunshine, iodine will be liberated, but no silver deposited.

Mr. Hunt has examined at length the action of the sun's rays upon some photographic preparations, (the salts of silver,) with many curious and interesting results, especially concerning the chloride of silver. Five grains of pure chloride of silver were put into a long test tube full of distilled water, and placed in the sunshine to darken, the powder being frequently moved, so that every part might be acted upon by the sun's rays. It was found, even after an exposure of a few minutes, that the water contained chlorine; (it became opaque on the addition of nitrate of silver;) and this was gradually increased as the chloride darkened. The darkening was continued for several hours, after which the solution was filtered to free it from chloride of silver, and nitrate of silver added to the filtered liquid; the chloride of silver precipitated, when collected and dried, weighed 1·4 grains on one occasion, 1 grain on another, and 1·5 grains on a third trial. From several other experiments on the chloride of silver, the author is inclined to believe that the first action of the solar rays is to liberate one half of the chlorine, which, moisture being present, is very readily replaced by oxygen. By the continued action of the exciting cause, the other proportional of the combined gaseous element is in like manner set free and replaced; and we now have oxide of silver, which in a short time is decomposed under the so called actinic power of the solar rays, and hence we have eventually nearly pure metallic silver in a state of extremely fine division. J. L. S.

2. *Effect of Cold on the Affinities of Substances.*—M. de Mareska has shown that sulphuric acid at —80° C. (—112° F.) no longer reddens tournesol, does not act upon the alkalies, the carbonates, iodide of potassium, nor chlorate of potassa. Phosphorus and arsenic react upon liquefied chlorine, surrounded by solid carbonic acid; and the same is true of ammonia. Bromine, iodine and sulphur, also, will combine with chlorine, though cooled to —80° C. or —90° C. Antimony in powder, put into liquid chlorine at —80° C. produces a disengagement of much heat and light; but there is no action, if the antimony be previously cooled down, or if dry chlorine gas be brought into contact with antimony placed in a tube inserted in solid carbonic acid. Potassium and sodium afford other examples of the same character.

3. ***Electric Currents produced by the Vibration of Wires and Metallic Rods;*** by W. Sullivan, (Phil. Mag., October, 1845, p. 261.) Mr. Sullivan, in his experiments on the electrical effect of vibration, took a piece of No. 15 brass wire, soldered it to a similar piece of iron wire, and stretched it over two uprights of a wooden frame, (about 18 inches apart,) so as to produce, when set in vibration, a musical note; the ends of this compound wire were then connected with an exceedingly delicate galvanometer; when in vibration a slight deviation of the needle took place, the direction of the current being from the iron to the brass, as in a similar thermo-electric circle. On

one or two occasions he noticed a deviation equal to that produced by heating the junction of the two wires to dull redness.

From some of the experiments, it would appear that when the wire vibrated continuously from end to end, the greatest effects were obtained; but when, from some cause, a nodal point was occasioned in the centre of the wire, and the two halves vibrated in the opposite direction, no effect was produced. As the amount of electricity developed by such means must be small, it was thought best to increase the masses set in vibration; and for this purpose, a bar of antimony five inches long, three eighths wide, and a quarter of an inch thick, was soldered end to end to a similar bar of bismuth; to the ends of the compound bar the wires of the galvanometer were attached. When suspended by a string, and set in vibration by striking with a piece of iron, results similar to the former were obtained, but of a more marked character; at times, considerable deviations were thus obtained, while very often no deviation whatever could be observed; the whole effect seeming to depend in some measure upon the manner in which the vibrations are propagated along the wire.

Two metals were not necessary to produce the effect, as a bar composed of crystalline hard iron and soft fibrous iron was capable of affording a current. J. L. S.

4. *Discovery of some new Earths in Zircons;* by L. Svanberg, (Chem. Gaz., October, 1845, p. 411.)—It has been discovered that zirconia, like the oxides of cerium and yttrium, is a mixture of several earths. The great difficulty attendant upon the separation of one from the other, has prevented M. Svanberg from studying their properties with a sufficient degree of accuracy. One of the earths which he found most abundant in the zircons from Norway, he has called *Noria*, from Nore, the old name of Norway. J. L. S.

5. *A new method of obtaining Chlorine;* by R. Oxland, (Chem. Gaz., October, 1845, p. 439.)—The process of manufacturing chlorine consists in a method of decomposing hydrochloric acid by means of atmospheric air. The hydrochloric acid gas and atmospheric air are mixed in the proportion of one measure of the former to two of the latter; and the mixture is passed through an air-tight furnace, kept at a bright red heat. The decomposing furnace is so arranged that the fire passes over the arch and under the bed;—the furnace is filled with pieces of pumice-stone, and the gas and air enter at the end farthest from the fire, and pass out at the other end through a pipe at the upper part of the furnace. The products resulting from the mixture passing through the decomposing furnace, consist of chlorine, associated with undecomposed muriatic acid, and any excess of atmospheric air and nitrogen. The mixture is cooled by passing through a series of

earthen tubes surrounded by water, after which, the hydrochloric acid is effectually separated by passing the mixture through water; and finally, the chlorine is obtained, and chloride of lime produced by passing the residuary mixture into the ordinary lime condenser, where the chlorine is absorbed, and the nitrogen and atmospheric air remaining are allowed to pass off. J. L. S.

6. *On the Solubility of the Basic Phosphate of Magnesia and Ammonia, and on the quantitative determination of Phosphoric Acid and Magnesia by means of this salt;* by Dr. R. Fresenius, (Annalen der Chem. und Pharm., July, 1845, p. 109.)—Chemists have been careful about washing this salt thoroughly, when used as a means of estimating magnesia quantitatively, on account of its supposed solubility. But in fact, when the salt is washed with water containing ammonia, hardly a trace of it will pass through the filter. One part of the ammonio-magnesian phosphate requires 44,330 parts of ammoniacal water for solution; which is equivalent to one part of magnesia in 120,760 parts, and one part phosphoric acid in 70,000 parts.

In estimating magnesia, it is well not to have too great an excess of ammoniacal salts in solution, and to wash the precipitates with ammoniacal water, until the water that passes through, leaves no residue when evaporated on a bit of platinum foil. The salt can be made use of as an accurate means of estimating phosphoric acid quantitatively, even when the acid is in combination with iron or alumina.

To analyze the phosphate of iron and alumina, first dissolve in muriatic acid, then add tartaric acid, and lastly, an excess of ammonia, until the whole of the precipitate that is first formed is redissolved; now add sulphate of magnesia, when the double salt in question will be precipitated—at the expiration of twelve hours, filter, wash with ammoniacal water, dry and ignite the filter and its contents, from the weight of which the phosphoric acid may now be calculated. In one experiment made with an artificial mixture of the phosphates of iron and alumina, this method indicated 20·14 per cent., when the quantity calculated to be present was 19·91. J. L. S.

7. *The decomposition of Water by Metals, promoted by the presence of Acids or Salts;* (Comptes Rendus, July, 1845, p. 37.)—This subject has been extensively investigated by M. Millon, and with highly interesting results. The rapidity of decomposition is sometimes increased a hundred fold, even by a minute quantity of certain salts. Pure zinc in dilute sulphuric acid, remains with little or no action, but on adding a small quantity of certain salts, decomposition commences at once, and hydrogen is evolved, though differing in the amount of action with the different salts used. Thus, if the action of pure dilute sulphuric acid is represented by 1, that of the bichloride of platinum is

149—of arsenous acid, 123—of sulphate of copper, 45—tartar emetic, 29—sulphate of silver, 24; and so with many other salts.

With very dilute muriatic acid, (1 to 40 of water,) the action is as follows: for bichloride of platinum, 43—arsenous acid, 38—tartar emetic, 35.

A solution of oxalic acid has no action on zinc, even when heated; but with a few drops of bichloride of platinum, the whole is soon converted into oxalate. The action of acetic acid is hastened by the same chloride, and also of tartaric and citric acids, diluted with four or five times their weight of water.

This addition of a salt, sometimes changes the result. Nitric acid, with 4½ equivalents of water, and diluted with two or three times its volume of water, poured on iron filings, causes a solution of the iron and the evolution of nitrous acid. But if only one drop of bichloride of platinum be added, hydrogen is evolved in place of nitrous acid, and protonitrate of iron with nitrate of ammonia are formed.

Bismuth, silver and mercury do not decompose water under any circumstances. Copper, in contact with bichloride of platinum and dilute hydrochloric acid, heated, gives off hydrogen freely; but the same chloride arrests at once the action of nitric acid.

These experiments were extended to other metals with equally important results. J. L. S.

8. *Action of the Alkalies on the Protosalts of Mercury;* (Jour. de Pharm., July, 1845.)—M. J. Lefort confirms the announcement of M. Guibourt, that the protonitrate and protochloride of mercury, mixed with caustic potash and soda, yield metallic mercury and the binoxide, in place of the protoxyd. The same is true of the carbonate, oxalate, iodate and acetate. J. L. S.

9. *Preparation of Iodic Acid;* (Chemist, July, 1845, from Liebig's Jahresb., April, 1845.)—M. Millon prepares iodic acid by mixing iodine and chlorate of potash, and heating, with water and a little nitric acid, until a rapid disengagement of chlorine takes place. In a short time the iodine is completely oxidized. The acid formed is precipitated by baryta, and separated again by sulphuric acid.

J. L. S.

10. *Oxidation by means of Cyanogen;* by M. P. C. Boudault, (Jour. de Pharm. et de Chim., June, 1845.)—Cyanogen, from its similarity to chlorine, bromine and iodine, might be supposed to possess the indirect oxidizing power of these agents. This M. Boudault has found to be the case, but owing to the instability of free cyanogen when dissolved in water, the experiments were made with one of the cyanogen compounds, in which the cyanogen was not in a strong state of combination, as is the case with the ferricyanide of potassium, or red

prussiate of potash. The oxides of manganese, nickel, cobalt, lead, copper and tin, in solution, are all peroxidized by having added to them a mixed solution of potash and ferricyanide of potassium, which last is converted into the ferrocyanide. The oxide of chrome, when dissolved in potash and boiled with the ferricyanide of potassium, is converted into chromate of potash, and if sufficient oxide be present, all the ferricyanide is converted into the ferrocyanide. Sulphur is oxidized by it, being converted into sulphuric acid; the same is true of phosphorous and sulphurous acids and their salts. Oxalic acid and the oxalates are instantly converted into carbonates, by being added to the solution of potash and ferricyanide. J. L. S.

11. *Action of the Bicarbonates of the Alkalies on the Vegetable Bases when Tartaric Acid is present;* by C. Oppermann, (Comptes Rendus, October, 1845, p. 810.)—It is well known that the presence of tartaric acid in solutions of the metallic salts, prevents their precipitation by an excess of ammonia and other reagents. M. Oppermann has found in his experiments, that when tartaric acid is present, sufficient to produce decided acid reaction, the salts of morphine are not precipitated by the bicarbonates, while those of narcotine are; the salts of strychnine are precipitated, and those of brucine not; the salts of cinchonine are precipitated, those of quinine not; the salts of veratrine acidified in the way mentioned, are precipitated by the bicarbonate of soda, but not by the bicarbonate of potash. The solutions of the salts were made with 1 part to 200 or 500 of water. It is seen by this, that where a plant contains two bases, the tartaric acid prevents the precipitation of one, but not of the other, a fact which may be taken advantage of in separating the two bases. J. L. S.

12. *On a new method of forming Chloral;* by M. Stadler, (Comp. Rendus, October, 1845, p. 820.)—The reaction of chlorine in its nascent state upon many organic substances, is found to produce chloral; starch, however, has been preferred. It is obtained mixed with formic acid and an oily body, which now occupies the attention of M. Städler, and which is procured by submitting to distillation a mixture of starch, binoxide of manganese, and hydrochloric acid. J. L. S.

13. *Quantitative determination of Lithia;* by C. Rammelsberg, (Chem. Gaz., December, 1845, p. 502, from Pogg. Annalen, 1845.)—When lithia and soda occur together, as is usually the case, there is, as is well known, no other method of estimating, except by precipitating the first in the form of a phosphate of soda and lithia, or by the arithmetical method of indirect analysis, first employed in chemistry by Richter. Both processes are undoubtedly imperfect, especially the first. Rammelsberg has found, after numerous experiments on various salts, that a mixture of alcohol and ether may be employed for the separation of

the chloride of sodium and chloride of lithium, with very satisfactory results; the latter salt being dissolved in this mixture. J. L. S.

14. *On the estimation of Fluorine;* by F. Wöhler, (Chem. Gaz., 1845, p. 403, from Pogg. Annalen, 1845.)—The weighed substance is intimately mixed with pure silica, unless it already contains this ingredient; the mixture is placed in a small flask, which can be weighed; very concentrated sulphuric acid, which has been boiled, is added, and the flask quickly closed with a cork, through which a small tube passes, that is filled with fused chloride of calcium, and drawn out to a point. The whole apparatus is now weighed, and then exposed to a proper heat as long as gaseous fluoride of silicon is evolved. The last portions are removed by exhaustion under the receiver of an air-pump. The loss in weight which it experiences is fluoride of silicon, from which the amount of fluorine is calculated. 1·395 parts of fluoride of silicon are formed for each part of fluorine. To test this method, the author estimated the amount of fluorine in fluor spar, and the results were accurate to the first decimal place. Care must be taken that no carbonates are present. J. L. S.

15. *Sulphurous Ether;* by MM. Ebelman and Bouquet, (Comptes Rendus, May, 1845.)—Sulphurous ether is formed by adding absolute alcohol by degrees to the protochloride of sulphur, until all action ceases; then distill the mixture—the first product that passes over is alcohol, acidulated by hydrochloric acid; but when the temperature of the liquid reaches 300°, the product in question begins to come over, and must be collected separately. It must be rectified until its boiling point remains constant. It is colorless, possessing an odor somewhat like mint; its taste is first cooling, then burning; it boils at 322° F.—dissolves in alcohol and ether, and is heavier than water, its density being 1·085. Composition $SO^2 C^4 H^5 O$. J. L. S.

16. *Production of Diaphanous Quartz and Hydrophane;* by M. Ebelman, (Comptes Rendus, August, 1845, p. 502.—When either of the two silicic ethers (see Am. Jour. Sci., July, 1845, p. 195) is exposed to the prolonged action of a moist atmosphere, the liquid solidifies to a transparent mass, which ultimately becomes hard, and has the lustre, fracture, and transparency of the most limpid rock crystal; its density is 1·77. It is a hydrate, having for its formula $(Si O)^2 HO$.

One condition necessary to produce this substance, is to allow the moist air to enter by a very small opening, to produce a very slow contraction and solidification. If the silicic ether employed retains a little chloride of silicon, which happens when an excess of alcohol has not been employed in the preparation of the ether, the quartz formed assumes the appearance of *hydrophane*, instead of being diaphanous: the greater the impurity, the greater the opacity. This hydrophane readily becomes transparent when placed in water. Almost any foreign substance present suffices to determine the quartz to assume the character of hydrophane. J. L. S.

17. *Test for Manganese;* by Walter Crum, (Annalen der Chem. und Pharm., August, 1845, p. 219.)—If peroxyd of lead be heated with dilute nitric acid, and there be added to it a solution of manganese, the liquid acquires the purplish-red color of permanganic acid, which is readily perceived as soon as the excess of peroxide has subsided. This is an extremely delicate test—by means of it a white marble was found to contain manganese. J. L. S.

18. *Valerianic Acid;* (from the Chem. Gazette, January 1, 1846, p. 9.)—The berries of the Viburnum opulus afford a volatile acid, which was called *phocenic* acid, by Chevreul, but afterwards was shown by Dumas to be identical with valerianic acid. L. von Monro has confirmed the view of Dumas.

19. *Atomic weight of Uranium;* (Pogg. Ann., lxvi, 91, 1845.)—Experiments by Rammelsberg, go to show that the weight of uranium is between 725 and 750, thus confirming the results of Wertheim and Ebelman, the former of whom obtained the number 746·36, by the analysis of the crystallized acetate of soda and uranium, and the latter 742·875, from the oxalate of uranium.

20. *Eudiometry;* (Chem. Gaz., January 1, 1846, p. 23.)—Prof. Graham recommends, for the rapid absorption of oxygen in the eudiometric process, a solution in ammonia of a sulphate of the suboxide of copper and ammonia. This salt falls as a brown powder when a stream of sulphurous acid gas is conveyed into a cold solution of the ammoniacal sulphate of copper. When dissolved in ammonia, it absorbs oxygen with singular avidity; and when employed in this form in eudiometry, gives results of considerable uniformity.

21. *Detection of Poisons by Physiological Tests;* (Buchner's Report, xxxvii, 3, and Chemist, July, 1845, p. 316.)—The eye is so delicate a test for atropine, (the alkaline principle of belladonna,) that, according to Rieck, $\frac{1}{1000}$ of a grain dissolved in water and applied to the eye of a rabbit, produces dilatation of the pupil; and even $\frac{1}{100000}$ of a grain, after having been twice applied to the eye, produces the same effect. Runge found that this alkaloid, as well as hyoscyamine, is evacuated by the urinary organs, and that the urine of rabbits, after they had taken either belladonna, stramonium or hyoscyamus, on being applied to the eyes of other animals, invariably produced a dilatation of the pupil.

It is known that strychnine and brucine are distinguished from all other alkaloids by the fact, that on being applied in very small quantities to a vein or fresh wound, they produce most violent irritation of the spinal marrow and motory nerves, accompanied with tetanic fits; this physiological fact may be made available in the detection of nux vomica or strychnine.

W. Arnold found that a living frog was the most delicate test for it; he ascertained that tetanus was produced in thirteen minutes after the introduction into a wound in the back, of the $\frac{1}{10000}$ of a grain of strychnine rubbed up with sugar of milk, and even the $\frac{1}{1000000}$ of a grain of the same narcotic, increased to a certain extent the irritability of the frog, after the lapse of half an hour or more.

Having in one of his experiments employed a frog, which, on the preceding day, had suffered from tetanus in consequence of a dose of $\frac{1}{10000}$ of a grain of strychnine, he found that in this animal $\frac{1}{1000000}$ of a grain produced tetanus, lasting for several hours and proving fatal.

It is also recommended to make use of the paralyzing effect of certain other narcotics (morphine, nicotine and cyanogen) upon the action of the heart of the frog, laid bare, as a means of deciding on their presence. J. L. S.

22. *Urinary Calculus*, (Chem. Gaz., November, 1845, p. 468, from Archiv. für Phys. und Prakt. Chem., 1845.)—Urostealite is the name given to a new calculus, by M. Heller, which was detected in the urine of a patient under his charge. It fuses, when heated strongly on a platinum foil, burns rapidly, and diffuses a strong but agreeable odor, which most resembles that of shell-lac and benzoin. It dissolves in ether, and also in warm alcohol. J. L. S.

23. *On the Milk of Carnivora;* by M. Dumas, (Comptes Rendus, September, 1845.)—The method by which the milk was analyzed is given in detail. If it be required to test for the sugar only, all that is necessary is to coagulate the boiling milk with a little acetic acid, evaporate nearly to dryness, (this had better be done under the receiver of an air-pump,) and the extract, which will have a gummy consistency, after standing for some time, yields crystals of sugar of milk, if it be present.

As a type of the milk of carnivorous animals, M. Dumas employed that of dogs fed upon flesh. He ascertained that in no instance was sugar present, nor could a trace of butyric acid be detected in the milk of dogs, after feeding them for fifteen days on flesh. Whereas, if the same dogs were fed upon farinaceous food, sugar was invariably detected, as well as butyric acid; (this acid, M. Pelouze pointed out a short time ago, was readily formed by fermenting sugar with casein.)

This author thinks that the fatty globules in milk are surrounded by casein, for when ether is shaken with milk, it will after some time separate from it, leaving the milk with all its original characters, while the ether will be found to contain no fatty matter. If we first add acetic

Digitized

acid, then boil the milk, allow it to cool, and shake it with ether, all the fatty matter will be taken up. J. L. S.

24. *Composition of the Urine of Herbivorous Animals;* by M. Boussingault, (Annales de Chim. et de Phys., Sept. 1845, p. 97.)—The details of these analyses are given at length, but all that can be presented here is a statement of the results.

	Urine of Hog, fed on potatoes.	Urine of Cow.	Urine of Horse.
Urea,	4·90	18·49	31·00
Bicarbonate of potash,	10·74	16·12	15·50
Carbonate of magnesia,	0·87	4·74	4·16
Carbonate of lime,	traces	0·55	10·82
Sulphate of potash,	1·98	3·60	1·18
Phosphate of potash,	1·02		
Chloride of sodium,	1·28	1·52	0·74
Lactate of an alkali,	undetermined.		
Silica,	0·07	traces	1·01
Hippurate of potash,		16·51	4·74
Lactate of potash,		17·16	11·28
Lactate of soda,			8·81
Water or Organic matter,	979·14	921·32	910·76
	1000·00	1000·00	1000·00

In the urine of the hog, no hippuric acid was detected. M. B. thinks it may have been owing to the exclusive nature of the diet. No phosphates were detected in the urine either of the cow or horse. J. L. S.

25. *Researches on the Composition of the Yolk of Egg;* by M. Gobley, (Comptes Rendus, Sept., 1845.)—These researches have been attended with two curious results.

1st. The discovery of a new acid not before known to exist in the animal economy, and but just produced artificially by M. Pelouze—the *phospho-glyceric acid*, (a compound acid of glycerine and phosphoric acid.) This acid in the yolk is in combination with ammonia.

2d. The discovery of margaric and oleic acids in combination with ammonia is a curious physiological fact, for hitherto the acids have only been found in combination with glycerine or with soda, in animal products. J. L. S.

26. *Water from the Artesian Well of Grenelle, at Paris,* (Chemist, July, 1845, from Med. Gaz., June, 1845.)—The Artesian well at Grenelle is the deepest but one in the world,* extending down 1794 feet, traversing chalk in the greater part of its course. Its temperature is 82°

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* The well of Mondrof is over 2200 feet deep, and they are still boring. It requires 3 hours to draw up the augur. The well is 1 foot diameter at the mouth, and 7 inches at the bottom. The water rises with a temperature of 95° Fahr.

F., which is 31° F. above the mean temperature of Paris. It rises 40 to 50 feet above the surface, and is discharged at the rate of 600 gallons per minute. 100.000 parts, after filtration, contained carbonate of lime 6·80, carbonate of magnesia 1·42, bicarbonate of potash 2·96, sulphate of potash 1·20, chloride of potassium 1·09, silica 0·57, organic azotized matter 0·26. J. L. S.

27. *Ancient Coins.*—M. Moessard has analyzed seven kinds of ancient coins, and finds them to consist of copper and tin, with occasionally a little silver, or traces of arsenic.

28. *Varnish for Eggs, Crabs, Insects, &c.*—Dissolve gum arabic 4 oz., and gum tragacanth ¼ oz., in 3 pints of water, add to the solution 20 grains of corrosive sublimate and 20 drops of oil of thyma dissolved in 4 oz. spirits of wine, mix well and let it stand a few days to separate: the clearer part is to be used as varnish, the thicker as cement.

29. *Goadby's solution*, for the preservation of specimens of soft animals without bones or shells, consists of *corrosive sublimate* 4 grains, *alum* 2 oz., *common salt* 4 oz., *water* 1 quart. Specimens should first be steeped in equal parts of water and this solution, and then put into the solution itself. It is recommended as the only material by which Medusæ can be preserved.

30. *Freezing of Water by the Air Pump, without the aid of Sulphuric Acid or any other desiccating agent;* by J. Lawrence Smith, (communicated by the author.)—In attempting to freeze water under the air-pump, without the aid of a desiccating agent, the cooling of the water to the point of congelation is prevented by the heat received from the containing vessel. I have lately found that by obviating this difficulty, water may be readily frozen by its own evaporation.

It was first shown by Count Rumford, that water does not wet a sooted surface, but forms in globules, like quicksilver. Three drops of water were placed in a sooted watch-glass; the spheroidal globule lay on the soot, exposing a large surface for evaporation, at the same time that the water was insulated from any source of heat. Arranged in this manner and placed under an air-pump, two or three minutes were sufficient to freeze the water. The glass was sooted over an oil lamp with great care; the experiment fails if the globule of water touches the glass even by a small point.

In place of the sooted watch-glass, make a shallow cavity in the end of a large cork, and over a lamp, burn it, sooting it at the same time. By putting three drops of water into the cavity thus prepared, and subjecting it to the action of the air-pump under a pint receiver, the water froze solid in a minute and a half; and in two and three fourths minutes, 20 grains of water congealed, though at 73° Fahr. when introduced. Under a receiver of three quarts capacity, 20 grains of water froze in four minutes. I could not succeed in freezing the same amount in the sooted watch-glass.

By placing corks, prepared as above, over a saucer of sulphuric acid, the same results are obtained more rapidly. I put half a drachm of water, at 65° Fahr., in each cavity, and exhausted the receiver till the mercurial gauge reached $\frac{4}{10}$ of an inch, which was effected in one minute. In a minute and a half, the water on one cork began to freeze, and in five minutes they were all frozen. An ounce of water, in a large flat cavity, froze in $3\frac{1}{2}$ minutes.

A flat-bottom porcelain capsule was prepared for an experiment on a large scale, by sooting it in the following manner. After coating it with soot over a lamp, and allowing it to cool a little, a small quantity of oil of turpentine was carefully poured upon the edge and passed over the entire surface; the vessel was then warmed to drive off the redundant turpentine. The surface was again coated with soot, and again with turpentine, and this process was repeated a third time; finally, another coating of soot was added, when it was ready for use. Two ounces of water were placed in this capsule under a receiver, and the air-pump worked for one minute. After standing six minutes, the surface was frozen.

This experiment, as well as similar ones, was attended with violent ebullition on the part of the liquid, throwing the water against the sides of the receiver, which was owing to the rapid formation of vapor on the under surface of the liquid.

II. Mineralogy and Geology.

1. *Chloanthite, a new Binarseniet of Nickel;* by A. Breithaupt.—This ore is from Schneeberg in Saxony. It differs from white nickel pyrites, in its tesseral crystallization with cubic cleavage. Specific gravity 6·423—6·565. Hardness $6\frac{1}{2}$—7. Color tin white. Composition, according to Mr. Booth, nickel 20·74, cobalt 3·37, iron 3·25, arsenic 72·64. (See this Journal, vol. xlvii, 351, and xxix, 242.)

2. *Cuban of Breithaupt;* (Pogg. Annalen, lxiv, 280, 1845.)—The mineral cuban, consists, according to C. H. Scheidauer, of sulphur 34·78, iron 42·51, copper 22·96, with a trace of lead, affording the formula $\dot{Fe}^2 + \dot{Cu}$.

3. *Kyrosite of Breithaupt;* (Pogg. Annalen, lxiv, 282, 1845.)—Scheidhauer obtains for the composition of kyrosite, sulphur 53·05, iron 45·60, copper 1·41, arsenic 0·93, which, excluding the copper and arsenic, is the composition of common sulphuret of iron.

4. *Turquois in Silesia;* (Pogg. Annalen, lxiv, 633, 1845.)—A new locality of this mineral near Domsdorf, in Silesia, is announced by E. F. Glocker. The color is in part a light apple green, and part be-

tween apple and grass green. It occurs in incrustations of small accretionary cylindrical stems.

5. *Crystalline form of Geocronite;* (Poggend. Annalen, lxv, 302, 1845.)—Crystals of Geocronite, from the Val di Costello, have an oblique rhombic primary, the lateral angle of which is 153°. They occur under the form of a six-sided prism, terminated in four-sided pyramids; one of the angles of the pyramid is 122°. The composition determined by T. Kerndt, is very similar to that obtained by Svanberg.

6. *Piauzite, a new mineral;* (L'Institut, Nov. 1845, No. 619, p. 400.)—M. Haidinger has detected a new resin near Neustadt, at Piauze. It is compact, with a slightly conchoidal fracture, brownish black color, and feebly translucent on the edges. Its density is 1·220, and it fuses at 515° C., burning with a brilliant flame, and a slightly aromatic odor. It dissolves completely in ether and a solution of caustic potash, and also almost entirely in *absolute* alcohol.

7. *Dysclasite.*—The primary form of the crystals of this mineral, as determined by Breithaupt, is a right rhombic prism of 122° 19′.

This mineral has been lately found abundantly, in a massive state, at Copper Harbor, Lake Superior.

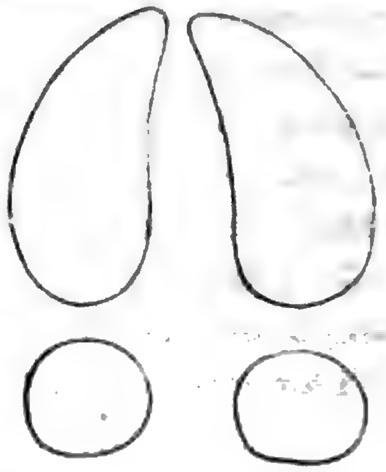
8. *Columbite and Wolfram;* (Pogg. Annalen, lxiv, 171, 1845.)—G. Rose, in his investigations of these minerals, has detected a close similarity in the forms and angles of their crystals, showing that they belong to the same system, and are approximately isomorphous. Three angles in Columbite have the values 100° 40′, 97° 29′, and 93° 16′, and the corresponding in Wolfram are 101° 5′, 99° 12′, 91° 54′. The cleavage is similar in direction in the two minerals, but is more perfect in Wolfram. The facts indicate that oxyd of niobium, which is contained in the Columbite, is isomorphous with oxyd of tungsten.

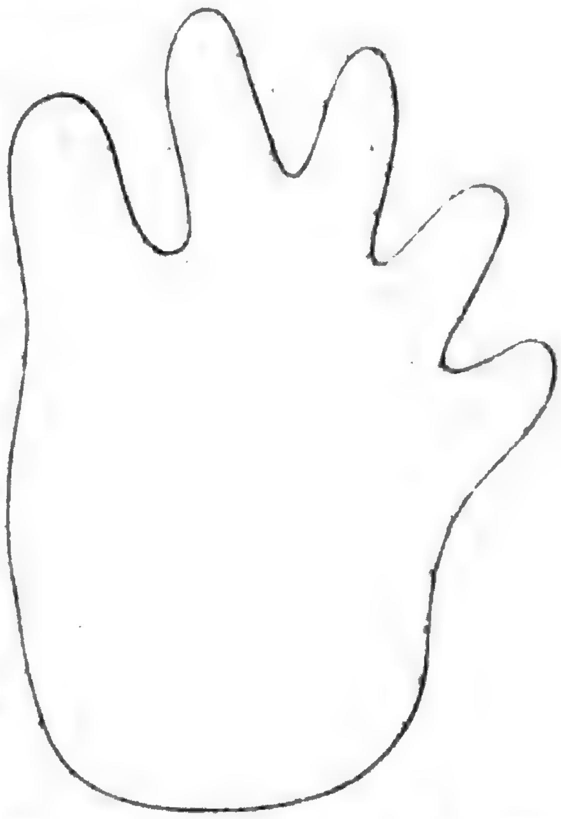
9. *Trichroism of Crystals;* (Poggend. Annalen, lxv, 1, 1845.)—M. Haidinger, in an elaborate memoir on the pleochroism of crystals, after describing at length instances of dichroism, and their peculiarities, enters into a consideration of the transmitted colors of crystals with three unequal axes, which he shows to afford instances of trichroism. The colors are observed either in the line of the axes, or perpendicular to the faces, and often appear different in six directions. Iolite, though called *dichroite*, is an example of this trichroism.

10. *Phosphorescence of the Diamond.*—P. Riess, experimenting on the phosphorescence of a large number of diamonds, found that in many of them, an exposure of half a minute to the sun's rays, caused them to give out light for fifteen to twenty minutes, on being removed into the dark. The phosphorescence produced by the red rays, continued longer than that from any other of the colors.

11. ***Footprints in the Coal Rocks of Westmoreland Co., Pennsylvania;*** by A. T. King.*—About 27 miles from this town, (Greensburgh,) on the summit of Chestnut ridge, one of the principal axes of elevation of the Alleghany range, are numerous imprints, which are very anomalous and remarkable. The greater number have much resemblance to the tracks of cloven-footed ruminant mammals. They are of various sizes, and differ from most living types, in having had heel-like prominences, which made impressions from 1 to 2 inches behind the main tracks.

The length of the largest track, including the posterior impressions, is 8 inches, and the breadth 5 inches. The smaller ones vary from 4½ to 5½ inches in length, by 3½ to 4½ in breadth. The general form is ovoidal, the largest part being behind, as well as the widest part of the cleft. The posterior imprints in the largest tracks, are each about the size of a walnut. There are five large and eight small tracks, in continuous lines, which are tolerably perfect, and many others which are much defaced. The imprints vary from 1½ to 2½ feet apart.





Besides these, there are from four to six huge tracks of a different character, and possibly Batrachian. They are in a continuous line, and each imprint is 13 inches long and 9 wide. There are 5 toes from 1½ to 2½ inches in length, and the second of them is the longest.

The average distance between the tracks is 3 feet 7 inches, with the exception of the last two, which are 7 feet apart. This seems to indicate that there was at one time a track between, which has been since obliterated.

12. *The Mastodon of Newburg, N. Y., discovered in August,* 1845.—Our readers are acquainted with the fact, that a noble specimen of the great American mastodon was exhumed in the month of August last, in the town of Newburg, N. Y. In regard to the state of preser-

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[*] The facts below are published in the Proceedings of the Academy of Natural Sciences, at Philadelphia, for Nov. and Dec. 1845, p. 299.

vation of the bones, the completeness of the skeleton, and perhaps its size, this is the most perfect which has yet been discovered. The bones contain a large portion of their gelatine, are firm in texture, light in color, and sonorous when struck. The number of bones found is sufficient to complete the skeleton with very slight exceptions, and to give a true idea of the osseous fabric of the animal. Some of the caudal vertebræ and a few bones of the feet only are missing, but those wanting in one foot exist in the other, both in the anterior and posterior extremity. As to size, its actual height cannot at present be stated with precision ; the length of the head however is three feet, and the breadth of the pelvis six feet. The tusks when discovered were ten feet long ; but a portion about four feet in length only of each tusk is well preserved : of the remainder, about four feet retains its form, the rest is decomposed. A very interesting fact in this specimen is the existence of an incisor tooth, or tusk, in the lower jaw on the left side, and the traces of the socket of another on the right.

This magnificent relic of a lost race is now insured to our country and its scientific resources, by having become the property of Dr. John C. Warren of Boston, Professor of Anatomy, &c. in Harvard University. The skeleton has been taken to pieces, and is now in process of re-articulation with the aid of all the light of comparative anatomy derived from scientific men, and from the skeletons of the elephant, tapir, and other pachydermatous animals. Every effort will be made, we are informed, to place the different parts in a strictly anatomical relation, and without any attempt to exaggerate the surprising dimensions of the animal. When set up, and protected from decomposition, it will be open to the inspection of men of science of this and foreign countries.

It is a little remarkable, that in the summer of 1844 a mastodon skeleton was discovered in New Jersey, which was at the period of its discovery more perfect than any other. The whole number of articulated mastodon skeletons which previously existed, was, we believe, only three, viz. Mr. Peale's in Philadelphia, and that in Baltimore, found in Newburg in 1802, and Dr. Koch's Missourium, in the British Museum, found in 1840. That of New Jersey was much more complete than those just mentioned ; but it wanted entirely the bones of the feet.

The whole of this skeleton, however, is in excellent preservation ; the bones are of a dark color, as the mastodon bones usually are, being impregnated with the oxide of iron, which no doubt has aided in their preservation. The tusks are perfect and short ; a fact, which together with the aperture of the pelvis compared with its whole breadth, which is four feet ten inches, supports the opinion of its being a female. It had no tusk in the lower jaw, nor any vestige of their previous existence.

Accompanying this skeleton there were two perfect heads, and also two additional lower jaws, together with a number of teeth and other bones. By means of the teeth, which were contained in the jaws of animals of different ages, a complete dental series is displayed from an early period in the calf to its termination in the adult.

This valuable collection has been purchased by a number of gentlemen in Boston with the intention of presenting it to Harvard University. It has already been described by Dr. John C. Warren at a meeting of the American Academy of Arts and Sciences in November last; and we learn that this gentleman will hereafter publish a minute description of both the specimens, accompanied with figures designed to represent them with accuracy. Some interesting points of anatomy will, it is hoped, be elucidated by these descriptions, and particularly the question of the existence of the Tetracaulodon as a distinct species.

13. *Missouri and Mississippi Valleys*, (from the Report intended to illustrate a map of the hydrographical basin of the Upper Mississippi River, made by I. N. Nicollet, Feb. 16, 1841. Washington, 1843.)—This valuable report by the late Mr. Nicollet, describes one of the most remarkable countries of lakes in the world. The map illustrating it is full of interest to the geologist, and was the result of vast labor. Mr. Nicollet was well known for his extensive learning in science, his accuracy in observation, and his untiring zeal. The report gives a topographical account of the region to which it relates, with numerous geological and botanical observations. As some account of the cretaceous and other formations of the Missouri has already appeared in the Journal, we cite at this time a few remarks on the Mississippi and Missouri valleys.

"The basin of the Upper Mississippi is separated in a great part of its extent from that of the Missouri by an elevated plain; the appearance of which, seen from the valley of the St. Peter's, or that of the *Rivière Jacques*, *looming as it were a distant shore*, has suggested for it the name of *Coteau des Prairies.* Its more appropriate designation would be that of *plateau*, which means something more than is conveyed to the mind by the expression, *a plain.*

"Its northern extremity is in latitude 46°, extending to 43°; after which it loses its distinctive elevation above the surrounding plains, and passes into rolling prairies. Its length is about two hundred miles, and its general direction N. N. W. and S. S. E. Its northern termination (called *Tête du Coteau* in consequence of its peculiar configuration) is not more than fifteen to twenty miles across; its elevation above the level of the Big Stone lake is eight hundred and ninety feet, and above the ocean nineteen hundred and sixteen feet. Starting from this extremity, (that is, the head of the Coteau,) the surface of the plateau is undulating, forming many dividing ridges which separate the waters flowing into the St. Peter's and the Mississippi from those of the Missouri.

"Under the 44th degree of latitude, the breadth of the Coteau is about forty miles, and its mean elevation is here reduced to fourteen hundred and fifty feet above the sea. Within this space its two slopes are rather abrupt, crowned with verdure, and scolloped by deep ravines thickly shaded with bushes, forming the beds of rivulets that water the subjacent plains.

"The Coteau itself is isolated, in the midst of boundless and fertile prairies, extending to the west, to the north, and into the valley of the St. Peter's.

"The plain at its northern extremity is a most beautiful tract of land, diversified by hills, dales, woodland, and lakes; the latter abounding in fish. This region of country is probably the most elevated between the Gulf of Mexico and Hudson's Bay. From its summit, proceeding from its western to its eastern limits, grand views are afforded. At its eastern border particularly, the prospect is magnificent beyond description, extending over the immense green turf that forms the basin of the Red River of the north, the forest-capped summits of the *hauteurs des terres* that surround the sources of the Mississippi, the granitic valley of the Upper St. Peter's, and the depressions in which are Lake Travers and the Big Stone lake. There can be no doubt that in future times this region will be the summer resort of the wealthy of the land."

14. *Palæozoic deposits of Scandinavia;* (Quar. Jour. Geol. Soc., No. 4.)—The great extent of the crystalline rocks in Scandinavia, is described by Mr. MURCHISON, as one of its most remarkable features. They occupy the great part of Sweden, rising into mountains and forming the flanks of troughs, containing palæozoic strata, which have in their turn been invaded by granitic, porphyritic, and trappean rocks of another epoch. The lowest fossiliferous rocks are Silurian. Above them are shales and coral limestones, corresponding to the Wenlock limestone of England, and flagstones and schists, which probably represent the Ludlow rocks. Many instances of metamorphic changes are instanced by Mr. Murchison. A few miles north of Drammen, a limestone, containing the Pentamerus oblongus, is changed to marble, near granite, and some portions were thickly impregnated with garnets, or even changed to a garnet rock. On receding from the granite, the strata resume their natural characters, and Pentameri appear again. At Christiana, on the east side of the bay, the greenstones and porphyries have changed a fucoid shale to a rock closely resembling gneiss. The alteration is gradual, from the stratified schists to the highly contorted and metamorphosed masses. Forchhammer supposes that the fusion of the gneiss, which the change is believed to have required,

took place through the aid of the potash (as a flux) in the shale derived from the decomposition of the imbedded fucoids. Murchison reasons, from the vast abundance of fuci in the existing seas of those regions, that the view is a probable one.

Gneiss, or granitic gneiss, is stated by Murchison to be the fundamental rock of Sweden, existing with often high inclinations, before the lowest Silurian beds began to be formed. The facts also show that the crystalline ridge of the Omberg, must have been upheaved long after it was metamorphosed and rendered crystalline, inasmuch as the lower Silurian rocks upon the granitic, though highly dislocated, occur as soft shales and impure unaltered limestones and sandstones. The upper Silurian rocks are almost wholly absent from the main land of Sweden, showing that the former country had been uplifted before their deposition, and the same exist exclusively in Gothland.

"When viewing the great features of the earth," says Mr. Murchison, "the geologist who compares the northern frontier of palæozoic deposits of Scandinavia and Russia with that of British North America, recently described by Captain Bayfield, cannot avoid being struck with the great similarity of succession in these two vast regions. In both, the general range of the rocks is from S. W. to N. E.; in both, the same type of lower Silurian deposits occurs, and rests upon more ancient crystalline rocks; and in both, are these strata succeeded in similar ascending order, by upper Silurian, Devonian, and Carboniferous deposits. We may still further pursue the analogy by stating that in both regions, great sheets of water range more or less along the older frontier line, and lastly, that in both, large quantities of erratic blocks have been transported from N. to S., or from N. N. W. to S. S. E."

"I will conclude this memoir by stating as one result of the examination of the fossils of Scandinavia, that as the lowest fossiliferous rocks of that tract are unequivocally of the same age as the lower Silurian rocks of Great Britain and America, so the deposits which occupy the governments of St. Petersburgh and Reval are the same as those of the continent of Sweden; in the latter country (I speak now of its central mass) no upper Silurian having yet been discovered.

"In both countries it would appear, (the central mass of Sweden only being alluded to,) that this group, proved to be protozoic by its having been deposited on antecedent crystalline and azoic rocks, is uncovered by upper Silurian, though the latter deposit is copiously and unequivocally exhibited in the great island of Gothland on the Swedish side, and in the smaller isles of Dago and Oesel, near the Russian shores. Thus it would seem that immediately after the completion of the lower Silurian group, these two continents were elevated and placed beyond the reach of the depositary influence of the sea in which the isles were formed, and therefore that in ancient times, as at the present day, a great trough existed between these opposite continental masses of land. This early elevation was probably unaccompanied by any great fractures; for the lower Silurian rocks of both lands have still preserved a general horizontality, which is the more remarkable in the case of Russia, as it has been shown that the sediments, after having been raised, must again have been depressed to permit of copious marine accumulations of Devonian age upon their surface. In like manner, we must believe from the evidences of conformable apposition of the Devonian and carboniferous deposits of Russia, that no sort of disturbing influence could have existed in these regions when the one formation succeeded to the other. The uppermost beds of the Devonian, loaded with *Holoptychius* and *Onchus*, *Coccosteus*, *Placosteus*, and *Dendrodus*, are at once conformably surmounted by strata containing the most universally diffused carboniferous types. In short, fishes identical with those of the Old Red Sandstone of Scotland, are invariably surmounted by the *Stigmaria ficoides* and the large Producti of our British mountain limestone; and thus the examination of Russia has taught us, not only in this instance, but also in the overlying Permian succession, that the great changes in animal life have not been dependent on physical revolutions of the surface, but are distinct creations, independent of any such proximate local causes; though I would by no means deny that the grand operations of change which have affected the conterminous regions of Russia did not tend to produce these results.

"The first elevation and depression of the lower Silurian strata having been moderate, and probably not extensive, and those strata having, during the long succeeding Devonian and carboniferous periods, remained beneath the sea, in which these sediments were accumulated, we next reach that period of disturbance which is so strongly marked in nearly every part of Europe, or that which followed the close of the carboniferous epoch. Then it was that the whole of the older palæozoic series of Northern Russia was raised up in lines extending from S. W. to N. E. And, although even then their elevation must have been infinitely more equable than any of those upheavals which have determined the strike and escarpments of rocks of the same age in Western Europe, we cannot imagine the upward movement of such enormous masses from beneath the sea to some height above it, without the accompaniment of some of those transverse fissures and breaks, which, though feeble in the slightly elevated tracks, increase in intensity, with the amount of upheaval."

15. *Lines of Ancient Level of the Sea in Finmark;* by M. A. Bravais, (extracted from the Quart. Jour. Geol. Soc., No. 4, 1845, p. 534.)—M. Bravais has ascertained two distinct lines of elevation around the

coast of Finland or North Norway: one 221·4 feet in height at the southern part of the Alten fjord, gradually diminishes to 92·3 feet near Hammerfest; the other is 91·3 feet at the former place, and 46 feet at the latter. He also detects some evidence of two other lines; one between the two just mentioned, and the second below the lower one; the evidence however he considers doubtful.

16. *Supposed Birds' Bones of the Wealden.*—(To the Editors of the American Journal of Science.)—GENTLEMEN: Will you oblige me by the insertion of the following remarks in an early number of your Journal, that the error to which they refer may be noticed as widely as possible. The evidence on which the presence of birds in the country of the Iguanodon was inferred, is fully stated in the "Medals of Creation," vol. ii, p. 806, and an accurate figure is given of a fragment of bone which was supposed to be the tarso-metatarsal of a wader, on the authority of a rigid comparison by Prof. Owen. That eminent zoologist having lately re-examined the specimen, now finds that he was mistaken in his former interpretation of its character, and concludes that it is the lower part of the humerus, of which the upper part is figured in my memoir on the fossil birds of the Wealden, Geol. Trans., vol. v: an opinion in which I entirely concur. In fact, I found the two pieces of bone near each other, and though the intervening portions both of bone and stone were wanting, the resemblance was such that I attached the bones to a card, and by a dotted outline indicated their connexion; but Prof. Owen thought I was mistaken, and I yielded to his authority. Prof. Owen, in a paper read a few days since to the Geological Society, refers this humerus to a Pterodactyle, and expresses his conviction that all the supposed birds' bones belong to Pterodactyles; but to this sweeping conclusion I cannot assent. The articulating surfaces of the humerus are very imperfect, and we have no certain clue to the original form of either the upper or lower articulation; it is therefore impossible to determine with precision as to the resemblance between this bone and the corresponding one of a bird or of a flying reptile. Baron Cuvier from other bones in my possession, expressed his belief in 1830, that the existence of the fossil remains of birds in these deposits was unquestionable. In the present state of our knowledge it appears to me, that, although it is *probable* that the bones in question will prove to be Pterodactylian, the evidence is not *conclusive;* some of them may be referred to birds—and this long mooted point remains therefore in the state it was when I first announced the discovery of bones belonging to animals capable of flight, in the strata of Tilgate Forest. In the language of the illustrious Cuvier, "*le temps confirmera ou infirmera cette idée.*" The jaws with teeth, and several bones of a Pterodactyle, have lately been found in the chalk of

Kent, and are in the collection of Mr. Bowerbank: it is possible that the large bones discovered in the same quarry, and referred to birds, may also belong to flying reptiles. This subject cannot fail to interest your geologists. When the interpretation of apparently indisputable characters by such high authority proves to be erroneous, it should inculcate the necessity of the utmost caution in our explanation of phenomena which must be regarded as far more equivocal. Should all the *Ornitholites* of our secondary strata be put to flight by some new discovery, your *Ornithichnites* will, I fear, be in jeopardy.

I am, gentlemen, your respectful servant,

GIDEON ALGERNON MANTELL.

Chester Square, Pimlico, London, December, 1845.

17. *Bones of the Iguanodon and other colossal reptiles recently found in the Isle of Wight, England.*—Brook Point in the Isle of Wight, must be known to our readers as a celebrated locality of the fluviatile deposits called Wealden, being described both in "The Wonders of Geology" and in "The Medals of Creation," by Dr. Mantell. A recent examination of this spot has led to some highly interesting discoveries, which have formed the subject of a communication lately laid by Dr. Mantell before the Geological Society of London, and which we trust will be published at length in the Transactions of that learned body. The occurrence of fossil trees along the strand at Brook Point, was first observed by the late Mr. Webster; and it is well known that water-worn fossil bones of reptiles have often been collected along the coast. The large fossil fresh-water muscle shells (*Unio valdensis*) described by Dr. M. in a former number of this Journal, are from the same place. The fossil trees that occur at Brook Point are imbedded in a sandy argillaceous rock, which forms the lowermost strata of the cliff: the stems and trunks visible beneath the sea weeds at low water, have been exposed in consequence of the removal of the deposit in which they were imbedded, by the action of the waves. The *bark* of these trees is in the state of lignite; the woody fibre is calcareous and permeated with veins of pyrites; coniferous structure is visible under the microscrope. With the trees are found bones of the Iguanodon, Cetiosaurus, Streptospondylus, Megalosaurus, and other colossal reptiles, and the Uniones above alluded to. From various data specified in the memoir, Dr. Mantell conceives that this collocation has taken place in consequence of the trees having originally formed a "raft," like those of our Mississippi, which drifted down the river of the country of the Iguanodon, entangling in its course the limbs of reptiles floating in the water, and the muscle shells in the sand or silt of the delta. Among the specimens recently collected by Dr. M., are the thigh-bone of an Iguanodon three feet four

inches long, and a portion of a tibia or leg-bone, which when perfect must have been between four and five feet long.

18. ***Notice of what appears to be the Embryo of an Ichthyosaurus in** the Pelvic cavity of Ichthyosaurus (communis ?)* by J. Chaning Pearce, (Ann. Mag. Nat. Hist., vol. xvii, pp. 44, 45, 46.)—In developing an *ichthyosaurus* which I took up from the rock in the brown laminated lias clay of Somersetshire, and having reversed the animal so as to lay bare that surface which was downwards in the quarry, I removed the clay with great care and exposed to view an *Ichthyosaurus communis ?* about eight and a half feet long, lying on its back in the highest state of preservation, and with the exception of a slight dislocation in the middle of the tail and the deficiency of its point, every part is most perfectly preserved. In cautiously lifting the laminæ of clay between the two hinder paddles, my attention was first arrested by a series of small vertebræ lying on three or four of the posterior ribs; on removing another portion of the clay, ribs, the rami of the jaw, and the other parts of the head were visible. In carefully cleaning this delicate little skeleton, it was found to rest on black, finely corrugated integument, which is preserved around the small skeleton, and passes underneath the posterior ribs and some other parts of the large animal.

The little animal, somewhat dislocated, lies at full length in the cavity of the pelvis, with its head towards the tail of the large one, and rests on the internal surface of its integument, and on the internal surfaces of three of its posterior left ribs, and is about five and a half inches long. The rami of the jaw and one of the longest ribs (of which only five or six are discernible) are each about an inch long; and of the thirty vertebræ which can be counted, the largest is the eighth of an inch in its longest diameter. It is bounded on either side by the ilium, ischium and pubis, and by the right and left posterior paddles, and on the right side by the vertebral column and right ribs; and while the posterior two-thirds of the little animal is within the pelvis, the head appears to protrude beyond it, and apparently in the act of being expelled at the time of death.

So singular a circumstance as an embryo being found in the pelvis of its parent in a fossil state, should lead to the greatest care in arriving at such a conclusion; but when we consider that the large animal was developed on its under surface—consequently it is nothing that has fallen upon it—and the remarkably correct position of the little skeleton in the pelvis, between the right and left ribs, with its head protruding, and the little vertebræ so exactly corresponding in shape to the large ones, and the other bones resembling those of a saurian, it appears fair to conclude that it cannot be anything else but a fœtal ichthyosaurus; and if it be suggested that it may have been swallowed by the animal, this involves a much greater difficulty; for so delicate a structure would have been dissolved by the gastric juice, and could not have reached its present position.

The Rev. Dr. Buckland and Prof. Owen, who have kindly written me on the subject, state, that there is no reason why the ichthyosaurus should not be viviparous, although "analogy of the nearest existing reptiles would point to its oviparity as the more probable kind of generation; but the genus Zootoca and the Viper show that analogy is no safe guide in such a question;" "and the European black and yellow salamander of Bohemia once brought forth young ones half as long as the mother, either in the doctor's pocket or college rooms;" therefore with such evidence it now appears fair to conclude that the Ichthyosauri were viviparous.

19. *Grooves or Scratches in North Wales;* by A. F. Macintosh, (Quart. Jour. Geol. Soc., No. 4, 1845, p. 460.)—Mr. Macintosh, after describing many instances of the fluting or striations of rocks in North Wales, proceeds to show that they cannot be explained by the hypothesis of icebergs, and must be attributed to peculiarity of structure in the rocks. In a case near Bedd Gelert, he remarks that the flutings are more regular, more accurately parallel and more symmetrically placed, than could be the case had they been produced by the passage of a glacier. There is scarcely any variation in depth or direction, and however numerous the lines, they are uniformly and strictly parallel. Phenomena of such a kind he concludes must be *structural.* Similar evidence in other regions is appealed to in support of this conclusion. Certain low rounded rocks in the valley of Llugwy are regularly furrowed in continuous parallel lines, not only from top to bottom, but on the sides accessible to view. Certain conglomerates have broader and wider flutings than the schists; and moreover, fragments of schist in these conglomerates have fine flutings wholly independent of the rock containing the fragments. Mr. Macintosh maintains farther that there is a connection between the flutings and the cleavage, the former being parallel with the latter. He suggests that the striated and furrowed rocks in the United States, attributed by Prof. Hitchcock to glacial action or ice, may be of structural origin.

20. *Phosphorite Rock of Estremadura, Spain, a good material for manure,* (Rep. Brit. Assoc. for 1844, p. 28.)—Prof. Daubeny states that this rock forms a solitary mass, penetrating clay-slate, the dimensions being at most fourteen feet in width, its length along the surface of the ground extending to about two miles. The composition is about 80 per cent. of triphosphate of lime and about 14 fluoride of calcium; and he suggests as a final cause of the secretion of so large a mass of both these substances in the older rocks, their being intended to supply

two necessary ingredients for bones and other animal matters. Such a rock, he observes, can hardly fail to be useful as a manure, if found in an accessible locality; and it would be worth the while for geologists to search for veins of this mineral in the older formations of this and other countries.

21. *Fresh-water Formation of the Smyrna Harbor*, (Quart. Jour. Geol. Soc., No. 2, p. 162.)—From the examination of fossils, Mr. E. Forbes has ascertained that the great fresh-water formation which skirts the Gulf of Smyrna and the coasts of many islands in the neighboring portion of the Archipelago, is of the age of the Paris basin and London clay. Whether the fresh-water tertiary basins of the interior of Asia Minor, and of the valley of the Xanthus, and the islands of Cos and Rhodes, are of the same age or not, remains still doubtful; though from the numerous fossils examined, Mr. Forbes is inclined to pronounce them of a later origin, yet anterior to the pliocene marine formations of Asia Minor and the Sporades. Of the fossils from Smyrna, one is the Limneus longiscatus of the Paris basin, and another apparently the L. ventricosus, also a Paris basin shell. Three species of Planorbis also are closely allied to, if not identical with, Paris basin fossils.

22. *Geology of New South Wales, New Holland and Van Dieman's Land*, (Strzelecki's New South Wales.)—The stratified rocks of New South Wales and New Holland, from the mica slate upward reach only to the variegated sandstone, which rock rests on the coal deposits. The whole thickness does not exceed 2200 feet, of which 1400 feet consist of sandstone alone. The crystalline and sedimentary rocks of New South Wales bear to one another the proportion of 3 to 1, and the former include granite, protogen, quartz rock, syenite, eurite, porphyry, greenstone and basalt. The coal of New Holland is bituminous and constitutes a series of beds 2 to 5 feet thick, alternating with sandstone and a soft clayey shale. The principal deposits are those of the Hunter River valley, which is worked at New Castle at the mouth of the river, and that of the district of Illawarra. Numerous fossil plants are found with the coal, among which the Glossopteris Browniana is by far the most prevalent form. Below the coal lie deposits of sandstone and limestones, which often abound in fossils.

23. *Salt Lakes and Coal Beds of Cape Breton;* from an account of its geology by Richard Brown, Esq., (Quart. Jour. Geol. Soc., No. 2, 1845, p. 207.)—The island of Cape Breton is separated from Nova Scotia by the Gut of Canso, and is about 120 miles long from north to south, and 90 miles wide. A line of highlands commencing at Cape North continues 60 miles to St. Ann's on the east shore, and as far to Margarie on the west shore, presenting with few exceptions bold cliffs

to the ocean. These highlands constitute a table land 15 to 20 miles broad, and 600 to 1000 feet high, in most places incapable of cultivation. Through the rest of the circuit the shore is mostly loose and undulating, or bordered by a bluff of 20 to 100 feet. In the very heart of the island there are two large salt-water lakes, each communicating with the sea, and one by a channel navigable for ships of the largest class. The Grand Cam is 40 miles in length and 20 in width. The scenery of the lakes is exceedingly striking, the conglomerates constituting long ranges of undulating blue hills, rising behind one another in the distance; whilst the white cliffs of gypsum stand out in bold relief on the margin of the water. Some idea of the extent of these lakes may be formed from the fact that there is no point in the island more than 12 miles distant from salt water. The shores of the lakes are thickly studded with the cottages of thriving settlers, and a narrow belt of cultivated land stretches along the water's edge.

The coal formation furnishes Newfoundland, Nova Scotia, and Prince Edward's Island with an abundant supply of coal, equal in quality to the best Newcastle. The coal field of Sydney on the northeast coast of the island, averages about 7 miles in width, and covers an area of 250 square miles; and this area is probably only the segment of an immense basin extending towards the coast of Newfoundland. The larger beds range from 4 to 7 feet in thickness, and besides, there are others of 2 feet. They rest on clay floors containing remains of Stigmaria. Trunks of trees, both vertical and inclined, are occasionally found; and also fishes' scales, teeth, fins and bones and coprolites. Along with the carboniferous limestone are extensive beds of gypsum and marls, and in the gypsum districts salt springs are not uncommon.

Granites, syenite and porphyries occupy a large part of Cape Breton, and the high table land is supposed to consist wholly of primary rocks.

24. *On the Palæontology of South America.*—M. Alcide D'Orbigny, the distinguished South American traveller, arrives at the following general conclusions in his work on South America,—chap. xii.

There is a general correspondence in the fauna of the successive formations of Europe and South America; and the earlier were in general the more simple forms of life.

No transitions between specific forms can be detected in rocks; living beings succeeded one another not by gradual transitions, but by the extinction of races and their replacement.

There are some identical species of fossils between the distant continents, proving the cotemporaneity of the rocks.

The uniformity of the fauna of the earlier periods, must be attributed in part to a uniform temperature, arising from central heat. This uniformity continues even to the era of the lower cretaceous deposits, when it began to be lost by the cooling of the earth; the limits to regions presenting the same conditions as regards heat and other circumstances, were thus contracted, and the fauna became diversified, being broken up into areas or basins of small extent. The cause of the strong line of division between the several formations, as indicated by the fauna, was some general catastrophe. The extinctions, more or less perfect, of races of fossils, were due to dislocations or disturbances of the earth's surface. The elevation of the Andes was one of these catastrophes.

Previous to the cretaceous formation, the heat of the earth proceeding from the central heat, was such as to render null all the influence of latitude in producing cold; and only subsequent to this period, has the last mentioned effect operated in localizing organic beings on the earth.

25. M. Agassiz *on the Geological Development of Animal Life*, (Ann. Mag. Nat. Hist., xvi, 355, from Jahrbuch für Mineralog. Geolog., &c., Part 3, 1845.)—The Zoophytes, Mollusca, and Articulata existed in the earliest period of the earth's development, although all their classes were not numerously represented in the oldest members; but they do not allow of our supposing that any progressive perfection to the present creation occurred. This is the case with the Vertebrata only, among which fish appeared in the first period, reptiles in the second; mammalia and birds did not appear for a long time after the former; lastly came man, as lord of all: hence M. Agassiz denominates the corresponding periods, those of fish, reptiles and mammalia.

The greatest change in the fish occurred at the end of the Jura period. All fish which existed prior to the chalk have a peculiar aspect and belong in general to extinct families; those of the latter epochs resemble those now living, and many of them belong to families and genera at present in existence; but they all differ specifically, just as *all* Vertebrata in different geological epochs differ in species.

26. *Fossil Shark*, (*Hybodus.*)—(Quart. Jour. Geol. Soc., 1845, No. 2, 197—with a plate.)—The entire mouth of a shark, partly open, has been found by B. Ibbetson in the Isle of Wight. The upper jaw measured ten inches, and appeared to have carried twenty four teeth in the front series. The discovery decides a doubted point, that the teeth of the two jaws are similar in form. The Genus Hybodus attains its maximum expansion in the oolite, but ranges from the muschelkalk to the chalk inclusive.

27. *Lower Green-sand Fossils.*—A catalogue of the fossils of the lower green-sand in the museum of the Geological Society, is given in the London Quart. Jour. Geol. Soc., No. 2, 1845, pp. 237–250. Some new species are described from the museum and other collections.

III. ZOOLOGY.

1. *On the Formation of Cells;* by M. COSTE, (Ann. Mag. Nat. Hist., xvi, 377, from Comptes Rendus, Oct. 20, 1845.)—The prevalent view with regard to the formation of cells, is a generalization of Purkinje's theory upon the development of the egg in the ovary. Its fundamental character consists in the supposed existence of four successive periods or phases in their development.

The *first* is represented by the appearance of the nucleolus, which is the basis of the structure, and itself results from a simple agglomeration of the molecules of the cytoblastema.

The *second* corresponds to the deposit and to the coagulation of the cytoblast or nucleus around the nucleolus, considered as the unique and exclusive centre of all cell-formation.

The *third*, to the deposition and coagulation of the cell-wall around the cytoblast, which it grasps at one point of its substance, and on one side of which it appears at first applied like a watch-glass upon its frame.

The *fourth* is expressed by the absorption of the nucleus and by the admission of cellular contents, which, being subsequently introduced, cannot consequently have taken any part in the formation of the parietal membrane.

Now if this is the sole mechanism by means of which all organic cells are developed,—if it be true that the four fundamental modifications which prepare the way for their walls are always produced in the order of succession which we have pointed out, it should result that wherever there are cells in the course of formation,—the cytoblastema should present in the metamorphoses of its substance, each of the material modifications which constitute the terms of this essential succession. If then the theory is to aspire to the rank of a general doctrine, it will be necessary that in the self-organizing mucus we should always be able to meet with the free nucleolus, the nucleolus enclosed by the cytoblast, the cytoblast at the moment at which the cell-wall is deposited on its periphery; and finally the cytoblast, enclosed in the thickness of the parietal membrane, disappearing in proportion as the cell contents are introduced into the cavity of the latter.

But when we search for the facts upon which so radically exclusive a theory is founded, we experience the twofold astonishment of not meeting, in those authors who originated it, with a single example, the value of which we cannot seriously contest, and of not finding in nature those abundant proofs which cause a system to prevail, or at least allow the formula to remain, as the most faithful expression of the most numerous category. Thus, in examining the proofs cited by Schwann in support of this hypothesis, we find that they may be reduced, as M. Vogt has remarked, to a single observation directly made on cartilage; and yet this observation, presented by Schwann himself as very doubtful, has been shown to be false by the researches of M. Vogt on the cartilage of the accoucheur-toad. In fact, in a very large number of cases, the nucleolus to which the theory attributes the exclusive privilege of causing the amorphous matter to produce the cell-walls—in a very large number of cases, I say, the nucleolus never appears free and isolated in the midst of the cytoblastema. On the contrary, we always find that this corpuscle, even from the first commencement of its appearance, is still enclosed in the cavity of the cell, which is previously formed, frequent instances of which we find in the tissues of the embryo of osseous fishes; it is evident that in these cases at least the nucleolus has taken no part in the formation of the cell, as it was not in existence when the latter was produced. In other cases, this corpuscle did not appear at any period of the existence of the cells, and consequently we should have no motive for making it intervene as a determining cause, since it does not leave to the theory even the pretext of co-existence. This may be easily verified by studying the development of the large cells which form the internal expansion of the umbilical vesicle of serpents.

Hence the tardy appearance of the nucleolus in certain cases, and its total absence in others, form a serious impediment to the theory which locates the exclusive determining cause of all cell-formation in the pre-existence of this corpuscle. This also shakes the very foundations of the doctrine, and tends at the least to restrain its application.

As regards the cytoblast or nucleus, M. Vogt has already shown that it has no influence on the formation of the cell-walls of the embryo of the osseous fishes; I have been enabled to convince myself that the large diaphanous vesicles in the spinal cord of the Batrachia do not appear until after the production of the parietal membrane of these vesicles.

But because the intervention of the nucleolus is not always necessary for the formation of the cells, and because the cytoblast or the nucleus does not itself, in a certain number of cases, retain the function assigned to it by theory, must we necessarily conclude that the cells are never developed around a centre upon which the forming walls would mould themselves? Undoubtedly we shall have frequent opportunities of observing limited masses of matter becoming coated with an envelope, and thus constituting the contents of the pouch which is formed at their periphery; but we shall then remark, that in most of these cases this happens in a very different manner from what the theory supposes; for the matter which has constituted the centre, instead of being absorbed by the parietal membrane, to make room for the cellular contents subsequently introduced, itself forms the cellular contents, fills the cavity of the new cell, may there be applied to different prolonged functions, may live longer than the cell itself, or remain in reserve in the cavity of the latter, to serve the further purposes of nutrition or generation of new cells. The egg, in the two united vesicles of which it is composed, presents us with striking examples of a survival of the matter which has served as a generating centre, because we there see the germinative corpuscles persist when the parietal membrane which encloses them is dissolved, and take part in the new formations after it has been completely absorbed. The yolk there survives the vitelline membrane, and whilst the latter is gradually destroyed from the earliest period of its development, we see the yolk continue to nourish the embryo until after its birth.

Such are the grave, numerous and decisive objections, which arise against a doctrine, which must rather be considered as a bold invention of the mind than the carefully considered expression of satisfactory observation; but although the bases of this doctrine are uncertain, it has not the less rendered an eminent service to science, because in the commencement it gave rise *à priori* to the conception of the possibility that cells might be developed around a centre; and its influence has been very great in directing observers in a fruitful path, and in exciting important researches, among which we may mention those of Valentin, Vogt, Bergmann, Reichert, Bischoff, Barry, Lebert and Henle. In my turn I shall make known the result of the observations which I have made upon so disputed a subject—observations which during several years have been many times detailed in the course of instruction which I give in the College of France.

2. *Microscopic Structure of Shells.*—An elaborate article on the microscopic structure of shells, by W. Carpenter, opens the volume of Reports of the British Association for 1844. It is illustrated by twenty plates, containing enlarged views of sections of various species of shells. The various facts ascertained are considered as proving that the calcerous matter is secreted within animal cellules, and owes its peculiar structure to this mode of formation. Many shells broken across have what appears to be a crystalline fibrous structure. This is eminently the case with the Pinna. But Mr. Carpenter shows that each minute prism is encased in animal membrane within which it was secreted; and by solution in acid, he obtained the animal portion having the same basaltiform character as the shell. In a transverse view magnified, the surface appears finely tesselated with polygonal areas, which with a power of 10 diameters are about a third of a line broad. This prismatic structure, when present at all in shells, forms the *external* portion, and is considered by Carpenter as corresponding to a *calcified epithelium.*

It thus corresponds with the enamel of teeth, to which it is analogous in every respect, save the character of the mineral secretion and the larger size of the prisms.

The inner portion of shells (and the whole of many) is described as destitute of the distinct prismatic structure, and no trace of cells can, for the most part, be distinguished. This is designated the *membranous* shell structure, and instead of corresponding to epithelium or epidermic secretions, like the prismatic portion, it is believed to proceed from the *true skin* below the epidermis. Mr. Carpenter considers the secretion as having been formed within cellules, but that these cellules disappeared by bursting or liquefying; a few only of these cellules remain entire which appear scattered through the layer.*

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* On polishing down the lamellæ of some *Astræa corals*, and examining with a microscope, nearly the same structure may be observed, as here described by Mr. Carpenter. There are no certain indications of regular cellules, even when magnified 300 diameters, and only a minutely clouded appearance is made out, too indefinite in character to be represented. By rubbing a crayon over a piece of paper a little rough, as good a figure of it would be had, as a more labored sketch could give. There were parallel bands of light and shade corresponding in direction with the margin of the plate, and with all its dentations, which indicated what other observations had shown, that these plates gradually enlarge by the extension of the edge; and this was the only evidence made out of regularity of structure. Examined with a polarizing attachment to the microscope, the thin slices permitted the polarized light to pass, but no colors were exhibited, except in points which were extremely minute when magnified 150 diameters, the power used in making the observation. This fact indicated that the coral plates were composed of minute granules, confusedly aggregated, as if each had been the result of independent formation, or the secretion of a separate animal cellule. There was no reason whatever to infer that the particles of the plate had been secreted, and accumulated by superposition, under crystallogenic forces; on the contrary the structure was completely amorphous, and such as could have resulted only from a mere aggregation of extremely minute granules, themselves crystalline. These lamellæ, it is well known, are *internal* secretions, as *also is the whole coral.*

The structure of the spicula in the Alcyonia appears to be somewhat different. These spicula are commonly five or six times as long as their greatest breadth, and are more or less pointed at each extremity. The surface is usually rough with minute prominences. When polished down very thin, faint lines varying in distinctness are seen to run parallel with the edge, through all its uneven outline; that is, there is evidence of a concentric structure, evincing that the spicula are formed by successive superpositions over the irregular surface. The concentric layers in the transsected knobs, have their edges towards the observer, and consequently they are not as transparent as the flat parts between. In polarized light the spicula exhibit brilliant colors; and the same magnifying power which gave scarcely visible points of color with the lamellæ of the Astræa, here afforded sheets half an inch or more in breadth, of rich green and flame tints. The spicula appeared therefore to be the result of a simple crystalline superposition of the calcareous material from the depositing secretions. With a power magnifying 300 diameters, no trace of animal cellules was distinguished, and no regular texture apart from the evidences of a concentric structure above stated. J. D. D.

The *nacreous* or *mother of pearl structure* has been supposed to be due to the cropping out of laminæ in succession. But Mr. Carpenter finds that the iridescence is exhibited by the animal membrane after the calcareous matter is removed, and moreover that it belongs to a *single* layer of membrane, and is owing to a corrugation of the surface or a series of folds or plaits, which lie more or less obliquely to the general surface.

Mr. Carpenter pursues the subject with great minuteness and skill, and ascertains characters from his investigations for determining the affiliation of groups. Characters also are afforded for distinguishing in many instances even species, and these characters it will be observed, are obtained from mere fragments.

3. *On Belemnites*, (Quarterly Journal of Geology, No. 1, p. 119.)—The Belemnite, whose connection with the Cephalopoda, or the cuttle-fish tribe, has been for some years determined, is regarded by Richard Owen, Esq., as forming a transition link between the two genera Sepia and Spirula, though uniting also some of the characters of the genera Sepiola and Onychoteutis. "The lateral fins of the Sepia are narrow, and extend from the apex of the mantle to near its base, while the fins of the Belemnite were relatively shorter and broader, and situated a little in advance of the middle of the body. In the relative size, shape and position of the fins, the Belemnite must have most nearly resembled the species of the existing Rossia and Sepiola; but it differed in the more elongated and slender body." "The Belemnite, with the advantage of its dart-shaped and well balanced shell, must have enjoyed the power of swimming backwards and forwards by the action of its cephalic and pallial fins, with greater vigor and precision than the modern Decapod Dibranchiata. The position of the animal was probably more habitually vertical than that of its recent congeners. Thus placed, the Belemnite, in quest of prey, would rise swiftly or stealthily to fix its claws in the belly of a supernatant fish, and then dart down to drag its prey to the bottom and drown it. And we cannot doubt that the ancient Belemnites were in their day the most formidable and predaceous of Cephalopods."

4. *Trilobites*, (ibid., p. 132.)—Burmeister, in a late treatise on Trilobites, places these fossil Crustacea among the Entomostraca, and near the genera Apus and Branchipus. Dr. Burmeister, as has been done by other naturalists, suggests that the fossils are often only the fossilized exuviæ, as these animals must have cast their exuviæ like other Crustacea. The so called genera *Battus* and *Agnostus*, he considers as *young* individuals of different species, in which state Crustacea often differ very widely from their adult forms. Dr. Burmeister concludes that they swam with the back undermost, and lived near coasts or in shallow waters.

5. *Fossil vertebræ of Shark*, (Trans. Roy. Soc., Edinb., xv, 643.)—The vertebræ of most cartilaginous fishes have been shown to have a bony nucleus or framework, and many do actually occur in the fossil state.

6. *General views on the Classification of Animals;* by J. D. Dana, (Proceed. Acad. Nat. Sci. Philad., ii, p. 281, Oct. 1845.)—In Cuvier's classification of animals, the division Radiata includes all invertebrated animals not comprised in either of the sub-kingdoms, Articulata and Mollusca. Consisting thus only of refuse species, and not limited by positive characters, as Owen states, we should not expect that the group could be a *natural* assemblage. No line of subdivision, however, has yet been made out, which has met with general favor; yet greater precision has been given to our views of the affinities that run through the animal kingdom, by appealing to the nerves, the seat of sensibility and sentiment, as a basis in classification; and in this manner the subdivisions have been characterized as follows by Dr. Grant.

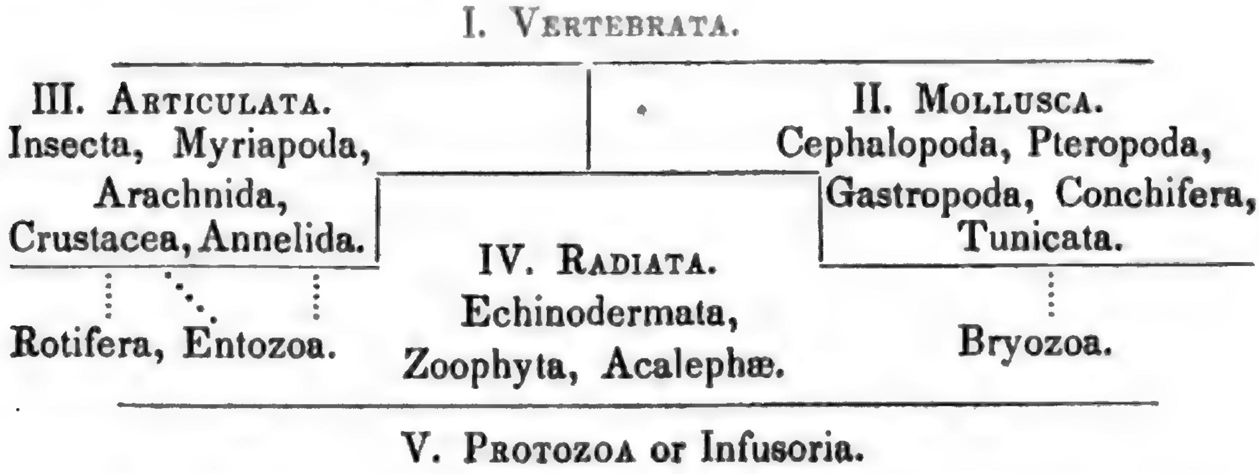
I. The *Vertebrata*, having a brain and a spinal cord, constitute the Spini-Vertebrata. II. The *Mollusca*, having the nerves forming generally a transverse series of ganglia disposed around the œsophagus, the Cyclo-gangliata. III. The *Articulata*, having no proper brain, and the main cord which runs the length of the body, double, the Diplo-neura. IV. The *Radiata*, having a radiate structure in the body, and the nervous ganglia arranged in a circle, Cyclo-neura.

An objection might be made to this system, on the ground of the apparent absence of nerves in some of the lower orders. But a real absence can hardly be concluded from our inability to distinguish them. Many of these animals show by their voluntary motions and sensibility that nervous influences traverse the body: moreover, nervous matter is secreted in lines. We can therefore only infer the indistinctness, and not the absence of nerves from our ineffectual efforts to trace them out; and we must consequently be guided by general structure, in determining the relations of groups, when the nerves fail of giving aid.

The above arrangement fails, in some respects, of presenting a clear idea of the system in nature, although highly philosophical in its general features. A study of the animal kingdom, as has been lately shown, brings to light lines or general systems of development branching up from the lowest Infusoria to the higher grades of life. It is not true that the forms among the *lower* grades are actually copied in any of the imperfectly developed young of the *superior;* yet there is some general analogy, sufficient to indicate that the former commence on the same system of development with some of the latter, although carried essentially out of the direct upward line by the peculiar vital forces of the species. The Rotifera are decidedly crustacean in type. Their stout mandibles are precisely those of the Cyclopacea in position, and also in general form; and in their mode of reproduction, the animals are closely similar; yet no young crustacean is ever a Rotifer. The latter belongs to the same system of development with the former, but is a distinct branch, from the regular line, characterized by the peculiar natatory organs, which appear to be the analogues of the branchial or basal appendages to the feet in Crustacea. The same reasoning applies to the Bryozoa or Flustroid polyps, which are as nearly allied to the Tunicata as the Rotifers to Crustacea.* It is a side-development from the imaginary line, which connects the Infusoria with the tunicated molluscs. The Entozoa afford other examples, one branch of them passing into the Crustacea through the Lernæidæ and Caligidæ, and another into the Annelida.

These remarks are intended to support no monad or Lamarckian theory, but only to elucidate the established principle that there are in nature certain distinct systems or types of development. Each species is developed with some reference to one or the other of these systems, but, through the agency of the vital forces peculiar to itself—forces which there is reason to believe only creative power can change.

In accordance with these principles, the several orders of animals may be arranged as follows:


I. VERTEBRATA.

III. ARTICULATA.
Insecta, Myriapoda,
Arachnida,
Crustacea, Annelida.

Rotifera, Entozoa.

II. MOLLUSCA.
Cephalopoda, Pteropoda,
Gastropoda, Conchifera,
Tunicata.

Bryozoa.

IV. RADIATA.
Echinodermata,
Zoophyta, Acalephæ.

V. PROTOZOA or Infusoria.

A radiated structure characterizes in general the simplest forms of animal life. Passing up from the monad globule, this structure has its highest development in the Echinoderms. Among Zoophytes, the Hydra forms the first step upward, in which the digestive cavity is a mere sac, which will work equally well inside out, and the mode of reproduction is extremely simple. From this group we pass to the Actinia, in which there is a distinct stomach and a series of fleshy lamellæ around the internal cavity—the first rudiments of an insolation of the functions of digestion and generation—but the circulating fluid is only the elaborated chyle mingled with more or less water from without. A step farther and we find separate organs for the functions of the liver, and a circulating system, in some Echinoderms. Through the Bryozoa, the Infusoria are connected with the Tunicata and the other Molluscs; and through the Rotifera and Entozoa, they connect with the Articulata, thus passing by each way, out of the true Radiate type, into that which characterizes the higher sub-kingdoms. The Bryozoa, Rotifera, and Entozoa, may be arranged in the sub-kingdom Radiata, or with the Mollusca and Articulata, whose types of structure they exhibit, though under a Radiate form.

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* The Bryozoa have been placed near the Rotifera; but the absence of mandibles, as well as their peculiar type of structure, separates them widely from these Crustaceoid species, and allies them as closely to the Tunicata, with which they were first associated by Thomson, under the name of Polyzoa. Lister has a finely illustrated article on this subject in the Philosophical Transactions for 1834, p. 365.

The Echinoderms, although so strikingly peculiar in some species—the Echini—yet through the Holothuria, bear closely upon the Articulata; while the Acalephs incline toward the Mollusca.

In the above remarks, it is not attempted to trace out all the gradations in the groups referred to, but only the most prominent. The animal kingdom is throughout a network of affiliations, yet there are main trunks and larger branches, to which the smaller anastomosing ramifications are subordinate. Much study will be required before the system of nature from the Protozoa up, can be correctly mapped out.

7. *Zoological Researches.*

Annals and Magazine of Natural History, for November, 1845.—On new Lepidoptera, by E. Doubleday, (continued.) Notice of a new genus of Nudibranchiate Molluscs, by J. Alder and A. Hancock.—G. R. Waterhouse, on some new Heteromerous Coleoptera.—L. Pfeiffer, descriptions of new land shells from Cuming's collections. *For December.*—On the Spongiadæ, with descriptions of some new genera, by J. S. Bowerbank; illustrated by two plates.—Descriptions of three species of Mus, one of Hapalotis and one of Podabrus, from Australia, by Mr. Gould. *For January.*—Descriptions of species of the genera of insects Phyllobius, Polydrosus and Metallites, by J. Walton.—New species of Spiders from Canada, by J. Blackwall, (to be continued.)—Continuation of a Memoir on New Holland Cryptocephalides, by W. W. Saunders.—Continuation of a Memoir on new exotic Lucanidæ, by J. O. Westwood.—Descriptions of new Buprestidæ, from New Holland, by the Rev. J. W. Hope.—J. Doubleday on some new Diurnal Lepidoptera.—A description and plate of the Delphinus tursio, by T. Brightwell.

Archiv für Naturgeschichte, 1845, Part I.—Sars, on the development of an Acaleph, and the Annelida; with figures.—A. Philippi, new shells, from a voyage around the world, by his brother E. B. Philippi.—S. Müller, on the Quadrumana of Sunda.—J. Müller, on the structure and classification of the Ganoid fishes. Part II.—A. Wagner, on new Rodentia from Brazil.—J. J. de Tschudi, Conspectus of the Reptiles of Peru.—M. Gurlt, Enumeration of the species of Entozoa, arranged according to the animals in which they are found.

Memoires de L'Institut de France, Tome xviii, 1843.—M. Milne Edwards, Observations on the Compound Ascidiæ of the north coast of France; an elaborate memoir illustrated by several plates of great beauty and perfection. Tome xix, 1845.—G. Breschet, Anatomical and Physiological researches on the gestation of the Quadrumana.

IV. ASTRONOMY.

1. *Note on the Eclipse of the Sun of April next.*—On Saturday the 25th of April, there will be an eclipse of the sun, which although but partial, even where largest, in the United States, will without doubt be carefully observed by every astronomer, as it will also be visible in Great Britain, and therefore of great value for the determination of his longitude from Greenwich, and as it will be the last large eclipse that will be visible to us for upwards of eight years, and the last that will be total in our vicinity until Aug. 7th, 1869.

In the English Nautical Almanac and the French Connaissance des Tems, the approaching eclipse is called central and *annular*, it having escaped the notice of the computers of those works, that although the tabular diameter of the moon is less than that of the sun, it is so nearly equal thereto, that a few degrees of altitude will render it apparently the greater, and consequently, the eclipse where central, *total;* but even where longest (near the island of Eleuthera) the duration of total darkness will not exceed 51 seconds, or the diameter of the moon's shadow, 22 miles.

By the following table it appears, that the duration of the central eclipse on the earth will be $3^h\ 34\frac{1}{2}^m$, and the length of its path about 9000 miles. For thirteen minutes after the beginning, and about seventeen before the end, of the central eclipse, or for about half an hour only, it will be annular; during the remainder of the time, or for upwards of three hours, it will be total, but so small is the extent of *land* to which the eclipse will be central, and so narrow the shadow of the moon, that Sagua la Grande, a town on the north side of the island of Cuba, appears to be the only place of note or importance on the earth that will see a total eclipse.

During the remainder of the present century, there will be but five eclipses central in any part of the Atlantic States, viz. those of May 26, 1854, and Sept. 29, 1875, annular in Massachusetts, and that of Oct. 19, 1865, in the Carolinas; whilst those of Aug. 7, 1869, and May 28, 1900, will be total in North Carolina and Virginia.

The following elements of the sun and of the moon, according to Burckhardt, were taken from the Nautical Almanac, but those according to Damoiseau were very carefully computed for Paris for four intervals of two hours each, and thence reduced to the meridian of Greenwich. The difference between these lunar tables is sometimes very considerable, amounting to 15 seconds and upwards; but on this occasion this fortunately is not the case, as during the continuance of the whole eclipse, the greatest difference in longitude is 2½ seconds, and in latitude and parallax 1½ only.

Path of the central eclipse over the earth, April 25th, 1846. Mean time at Greenwich:

Eclipse central at	In Latitude.	In Longitude.	Eclipse central at	In Lat. N.	In Lon. W.	Eclipse central at	In Lat. N.	In Lon. W.
h. m. s.	° ′	° ′	h. m. s.	° ′	° ′	h. m. s.	° ′	° ′
3 3 11	2 13·9 s.	135 47·5 w.	4 28 00	21 19·2	82 55·2	5 17 30	27 51·7	67 25·5
3 3 18	1 27·8	132 39·7	4 29 00	21 28·7	82 37·3	5 20 00	28 7·1	66 32·6
3 5 00	0 24·1 n.	126 3·8	4 30 00	21 38·1	82 19·5	5 22 30	28 21·9	65 38·7
3 7 30	1 57·2	121 20·6	4 31 00	21 47·4	82 1·7	5 25 00	28 36·1	64 43·8
3 10 00	3 9·5	118 1·6	4 32 00	21 56·7	81 43·8	5 27 30	28 49·8	63 47·8
3 12 30	4 11·9	115 22·3	4 33 00	22 6·0	81 26·0	5 30 00	29 3·0	62 50·5
3 15 00	5 8·1	113 7·1	4 34 00	22 15·2	81 8·1	5 32 30	29 15·6	61 52·0
3 17 30	5 59·8	111 8·6	4 35 00	22 24·4	80 50·3	5 35 00	29 27·5	60 52·1
3 20 00	6 48·3	109 21·9	4 36 00	22 33·5	80 32·4	5 37 30	29 38 9	59 50·8
3 22 30	7 34·1	107 44·7	4 37 00	22 42·5	80 14·6	5 40 00	29 49·6	58 47·9
3 25 00	8 17·7	106 15·2	4 38 00	22 51·5	79 56·7	5 42 30	29 59·6	57 43·4
3 27 30	8 59·5	104 51·9	4 39 00	23 0·4	79 38·8	5 45 00	30 9·0	56 37·1
3 30 00	9 39·7	103 33·8	4 40 00	23 9·2	79 20·9	5 47 30	30 17·6	55 28·8
3 32 30	10 18·5	102 20·0	4 41 00	23 17·9	79 3·0	5 50 00	30 25·3	54 18·5
3 35 00	10 56·0	101 10·0	4 42 00	23 26·6	78 45·0	5 52 30	30 32·2	53 5·9
3 37 30	11 32·4	100 3·2	4 43 00	23 35·3	78 27·0	5 55 00	30 38·3	51 50·8
3 40 00	12 7·8	98 59·2	4 44 00	23 43·9	78 9·1	5 57 30	30 43·4	50 33·0
3 42 30	12 42·3	97 57·6	4 45 00	23 52·4	77 51·0	6 00 00	30 47·5	49 12·3
3 45 00	13 15·9	96 58·4	4 46 00	24 0·8	77 32·9	6 2 30	30 50·4	47 48·4
3 47 30	13 48·8	96 1·0	4 47 00	24 9·2	77 14·7	6 5 00	30 52·1	46 20·8
3 50 00	14 20·9	95 5·3	4 48 00	24 17·5	76 56·5	6 7 30	30 52·5	44 49·2
3 52 30	14 52·3	94 11·2	4 49 00	24 25·7	76 38·3	6 10 00	30 51·5	43 13·1
3 55 00	15 23·1	93 18·5	4 50 00	24 33·9	76 20·0	6 12 30	30 48·8	41 31·9
3 57 30	15 53·2	92 27·0	4 51 00	24 42·0	76 1·7	6 15 00	30 44·3	39 44·7
4 00 00	16 22·7	91 36·5	4 52 00	24 50·0	75 43·3	6 17 30	30 37·7	37 50·5
4 2 30	16 51·7	90 47·0	4 53 00	24 58·0	75 24·8	6 20 00	30 28·7	35 48·1
4 5 00	17 20·1	89 58·3	4 54 00	25 5·9	75 6·3	6 22 30	30 16·8	33 35·5
4 7 30	17 48·0	89 10·4	4 55 00	25 13·7	74 47·7	6 25 00	30 1·2	31 9·9
4 10 00	18 15·4	88 23·1	4 57 30	25 33·0	74 1·0	6 27 30	29 41·0	28 27·9
4 12 30	18 42·3	87 36·4	5 00 00	25 51·9	73 13·8	6 30 00	29 14·6	25 22·2
4 15 00	19 8·8	86 50·2	5 2 30	26 10·4	72 26·1	6 32 30	28 38·7	21 40·2
4 17 30	19 34·9	86 4·4	5 5 00	26 28·4	71 37·7	6 35 00	27 45·5	16 49·4
4 20 00	20 0·5	85 19·0	5 7 30	26 46·0	70 48·7	6 36 00	27 14·4	14 12·9
4 22 30	20 25·6	84 33·9	5 10 00	27 3·1	69 59·0	6 37 00	26 28·6	10 35·7
4 25 00	20 50·3	83 48·9	5 12 30	27 19·7	69 8·6	6 37 36	25 36·3	6 43·4
4 26 00	21 0·0	83 31·0	5 15 00	27 35·9	68 17·5	6 37 44⅓	24 54·4	3 44·4
4 27 00	21 9·6	83 13·1						

Duration of central eclipse, . . $3^{h}\ 34^{m}\ 33\frac{1}{3}^{s}$.
Total, from . . . . . $3^{h}\ 16^{m}$ to $6^{h}\ 21^{m}$.

Sun centrally eclipsed on the meridian at $4^{h}\ 55^{m}\ 54{\cdot}5^{s}$ in latitude 25° 20′·8, longitude 74° 30′·8.

Do. do. by Damoiseau at $4^{h}\ 55^{m}\ 59{\cdot}9^{s}$ in latitude 25° 22′·5, longitude 74° 32′·2.

Phases of the eclipse at several places in the United States and in the island of Cuba, in *mean* solar, civil time.

⁂ The points on the right and left sides of the sun, first and last touched by the moon, or at which the eclipse will begin and end, are counted from the vertex, as seen through an *erect* telescope. For a telescope that inverts, add 180°.

	BOSTON, State House.	CAMBRIDGE, Astronomical Observatory.	CHARLESTON, St. Michael's Church.	CINCINNATI, Astronomical Observatory.	EASTPORT, Campobello Observatory.
Latitude,	42° 21′ 23″	42° 22′ 48″	32° 46′ 33″	39° 5′ 54″	44° 53′ 33″
Longitude,	71 4 9	71 8 2	79 57 27	84 34 0	66 57 14
	h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
Eclipse begins,	11 14 45·1 M.	11 14 27·3 M.	10 3 36·9 M.	9 55 14·1 M.	11 42 51·0 M.
Apparent ecliptic ☌	0 33 54·1 A.	0 33 31·6 A.	11 30 11·3 "	11 9 1·5 "	0 59 25·1 A.
Greatest obscur'n,	0 34 18·3 "	0 33 54·9 "	11 32 7·4 "	11 11 35·9 "	0 58 55·5 "
Eclipse ends,	1 52 43·0 "	1 52 18·1 "	1 4 20·0 A.	0 31 31·7 A.	2 12 50·8 "
Duration,	2 37 57·9	2 37 50·8	3 0 43·1	2 36 17·6	2 29 59·8
Digits eclipsed,	6° 40′	6° 39′	8° 49′	6° 14′	6° 9′
Point first touched	121 55	121 54	81 28	101 17	134 17
Point last touched	62 41	62 51	48 8	82 5	66 6

	HAVANNA, the Morro.	MATANZAS.	NEW YORK, City Hall.	PHILADELPHIA, High School Observatory.	WASHINGTON, New Observatory.
Latitude,	23° 9′ 26″	23° 2′ 30″	40° 42′ 40″	39° 57′ 8″	38° 53′ 41″
Longitude,	82 22 21	81 33 50	74 1 8	75 10 37	77 3 54
	h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*
Eclipse begins,	9 29 58·9 M.	9 34 21·1 M.	10 54 49·7 M.	10 46 43·6 M.	10 33 56·9 M.
Apparent ecliptic ☌	11 2 24·0 "	11 7 37·1 "	0 14 57·6 A.	0 7 17·1 A.	11 54 44·7 "
Greatest obscur'n,	11 2 51·9 "	11 7 54·9 "	0 15 58 6 "	0 8 34·2 "	11 56 10·3 "
Eclipse ends,	0 44 17·7 A.	0 49 40·5 A.	1 36 57·7 "	1 30 38·5 "	1 19 51·2 A.
Duration,	3 14 18·8	3 15 19·4	2 42 8·0	2 43 54·9	2 45 54·3
Digits eclipsed,	11° 34′	11° 44′	6° 56′	7° 4′	7° 12′
Point first touched	47 15	48 54	113 18	109 35	104 20
Point last touched	21 15	17 3	61 47	61 16	61 33

At Eastport, (Campobello Observatory,) the greatest obscuration will take place *before* the apparent ecliptic conjunction ; and at each of the above places, the southern side of the sun will be eclipsed. For several of these places, the eclipse was also computed by the tables of Damoiseau, with the following results :

	Beginn. sec.	Ap. ☌. sec.	End. sec.	Duration. sec.
Boston and Camb.	*Add* 1·8	5·7	7·8	6·0
Charleston,	" 3·2		7·8	4·6
Cincinnati,	" 1·4	6·6	10·0	8·6
Eastport,	" 1·2	5·3	7·6	6·4
Philadelphia,	" 2·0	6·2	8·1	6·1
Washington,	" 2·1	6·3	8·1	6·0

At Belize, (Fort St. George,) Honduras, lat. 17° 29′ 20″, long. 88° 8′ 20″, the greatest obscuration will take place at 10h. 16m. 39s. M. Digits eclipsed 11° 46½′ on the *north* limb.

At Cardenas, Cuba, lat. 23° 2′ 30″, long. 81° 11′ 50″, greatest obscuration at 11h. 10m. 18s. M. Digits eclipsed 11° 47′ on the *south* limb.

At Cienfuegos, lat. 22° 7′ 30″, long. 80° 37′ 40″, greatest obscuration at 11h. 12m. 42s. M. Digits eclipsed 11° 54′ on the *north* limb.

At Santa Clara or Villa Clara, lat. 22° 22′ 30″, long. 80° 5′, greatest obscuration at 11h. 16m. 34s. M. Digits eclipsed 11° 55′ on the *north* limb.

At the following places, the eclipse will be total, and very nearly central.

	Sagua la Grande. Lat. 22° 48′ 20″, Lon. 80° 4′ 35″.		*Place near Sagua.* Lat. 22° 42′ 18″. Lon. 80° 14′ 30″.	
	Burckhardt.	Damoiseau.	Burckhardt.	Damoiseau.
	h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*
Beginning of the eclipse, .	9 42 29·3 M.	9 42 34·3 M.	9 41 20·9 M.	9 41 26.1 M.
“ total darkness,	11 16 51·5	11 16 58·6	11 15 36·8	11 15 44·7
Nearest approach of centres,	11 17 16·5	11 17 23·6	11 16 1·8	11 16 8·8
End of total darkness, . .	11 17 41·5	11 17 48·5	11 16 26 8	11 16 32·9
“ the eclipse, . . .	0 59 30·0 A.	0 59 36·8 A.	0 58 17·1 A.	0 58 23·9 A.
Duration of total darkness,	50.0	49·9	50·0	48·2
“ the eclipse, .	3 17 0.7	3 17 2·5	3 16 56·2	3 16 57·8
Point first touched, . . .	47° 31′	47° 27′	47° 15′	47° 11′
“ last touched, . . .	11° 11′	11° 4′	11° 16′	11° 10′
At the nearest approach { Dist. north limbs,	8″·55	6″·56	7″·63	5″ 63
“ of centres,	0″·57	1″·51	0″·35	2″·44
“ south limbs,	7″·41	9″·58	8″·33	10″·51

Elements of the Eclipse, mean time at Greenwich:

Hour.	⊙'s Long.	Lat.	Rt. Ascen.	Declinat.	Semidi.	Sid. time.	
	° ′ ″	″	° ′ ″	° ′ ″	′ ″	*h. m. s.*	
2	34 57 13·83	—0·19	32 40 10·58	13 10 57·92	15 54·48	2 12 48·20	
3	34 59 39·75	—0.20	32 42 31.79	13 11 46·80	15 54·47	2 12 58·05	Obliquity 23° 27′ 26″·46
4	35 2 5·66	—0·20	32 44 53·01	13 12 35·66	15 54·46	2 13 7.91	⊙'s Hor. Par. 8·52
5	35 4 31·56	—0·21	32 47 14·24	13 13 24·49	15 54·45	2 12 17·77	Ellipticity $\frac{1}{300}$
6	35 6 57·46	—0·22	32 49 35·49	13 14 13·30	15 54·44	2 12 27·62	
7	35 9 23·36	—0·22	32 51 56·75	13 15 2·09	15 54·43	2 12 37·48	
8	35 11 49·26	—0·23	32 54 18·03	13 15 50·86	15 54·42	2 12 47·34	

Lunar Elements according to Burckhardt:

Hour.	Longitude.	Latitude.	Right Ascen.	Declination.	Hor. Par.	Hor. S. D.
	° ′ ″	′ ″	° ′ ″	° ′ ″	′ ″	′ ″
2	33 28 51·91	+20 28·25	31 7 41·18	13 0 22·3	57 58·23	15 47·78
3	34 2 49·96	17 20·16	31 41 34·64	13 8 57·8	57 56·73	15 47·37
4	34 36 46·25	14 12·16	32 15 28.71	13 17 28·4	57 55·23	15 46·96
5	35 10 40·77	11 4·25	32 49 23·39	13 25 54·1	57 53·72	15 46·54
6	35 44 33.52	7 56·43	33 23 18·69	13 34 14·9	57 52·20	15 46·13
7	36 18 24·48	4 48·72	33 57 14·60	13 42 30·6	57 50·67	15 45·71
8	36 52 13·65	1 41·15	34 31 11·13	13 50 41·2	57 49·13	15 45·30

Lunar Elements according to Damoiseau:

Hour.	Longitude.		Latitude.		Hor. Par.	Hor. S. D.
	° ′ ″		′ ″		′ ″	′ ″
2	33 28 51·23		+20 29·69		57 56·73	15 47·87
		33′ 57″·24		3′ 8″·04		
3	34 2 48·47		17 21·65		57 55·23	15 47·46
		33 55·75		3 7·98		
4	34 36 44·22		14 13·67		57 53·73	15 47·05
		33 54·20		3 7·93		
5	35 10 38·42		11 5·74		57 52·22	15 46 63
		33 52·58		3 7·88		
6	35 44 31·00		7 57·86		57 50·70	15 46·22
		33 50·90		3 7·80		
7	36 18 21·90		4 50.06		57 49·18	15 45·80
		33 49·17		3 7·70		
8	36 52 11·07		1 42·36		57 47·64	15 45·39

Boston, February 9th, 1846. R. T. P.

2. *A new Planet.*—On the 8th of December, 1845, M. Hencke, of Driesen, found a star of the ninth magnitude in Taurus, where before there was none. At 8 o'clock, its place was A. R. 65° 25′, Dec. 12° 41′ N. On the 14th, it was observed by M. Encke, at Berlin, at 13h. 57m., m. t., A.R. 64° 0′ 23″·6, Dec. 12° 39′ 53″·1.

On the 24th, it was observed at London, by Mr. Hind, at 0h. 20m., sid. time, A.R. 4h. 8m. 17·56s., Dec. 12° 45′ 32″·6.

On the 30th of December, at 4h. 39m. Greenwich sid. time, it was found in A.R. 4h. 4m. 32s. Dec. 12° 55′ 26″.

This star is believed to be a new planet, near its opposition. Its motion was retrograde, and at the rate of about a quarter of a degree per day, through the month of December. It appears faint in a good 30 inch telescope. The discoverer left the determination of the name to M. Encke, who calls it *Astræa.*

The following approximate elements were furnished by Professor Schumacher.

Mean longitude, 1840, Jan. 0,	89° 32′ 12″·1
Longitude of perihelion,	214° 53′ 7″·0
Longitude of ascending node,	119° 44′ 37″·5
Inclination of orbit,	7° 42′ 8″·4
Eccentricity,	0·207993
Semi-axis major,	2·6390
Mean daily motion in longitude,	827″·65
Periodic time,	1565 days.

According to these elements, the new planet approaches very near the orbit of Juno, and its eccentricity is nearly the same.

3. *Biela's Comet.*—This remarkable body has again made its appearance, and has been observed at various places in this country. It was seen at Cambridge, England, with the Northumberland Equatorial, December 1st, 1845. It passed its perihelion on the 11th of February, and will be nearest to the earth about the middle of March, when it may possibly be seen by the naked eye. This comet was observed in 1772, 1805, 1826, and 1832. During its present return, it has exhibited a very remarkable appearance. When first observed through the five inch refractor at Yale College, Dec. 29, 1845, the comet was seen attended by a faint nebulous spot preceding, estimated to be rather more than a minute of space distant from its brightest point. The few subsequent observations which the clouds and the moonlight permitted here before the middle of January, showed this secondary comet to be brightening faster than the principal, and slowly departing from it. This surprising phenomenon was first publicly announced in this country, by Lieut. Maury, of the Washington Observatory. On the 22d of January, according to Mr. S. C. Walker, the two portions were about

one and a half minutes of space apart. Each portion presented the usual characteristics of a telescopic comet, being gradually condensed towards the centre, without any well defined disc; each having a tail extending from the side opposite the sun.

The following are Santini's elements of this comet, as given in Schumacher's Ast. Nach., No. 491.

Perihelion passage,	1846, Feb. 11.40127 M. T. at Padua.	
Longitude of perihelion,	109° 4′ 29″·11	Mean equinox of Feb. 11, 1846.
Longitude of node,	245° 57′ 24″·46	
Inclination,	12° 35′ 25″·85	
Eccentricity,	49° 10′ 39″·98	
Mean daily motion,	537·653627	
Log. semi-axis major,	0·5463360	

The following ephemeris computed from these elements, is for 12h. mean time at Padua.

	A. R.	Dec.	Log. dist. from sun.	Log. dist. from earth.
March 3	52° 7′	8° 44′S.	9·96124	9·6312
7	59 5	10 0	9·97253	9·6100
11	66 39	11 13	9·98500	9·5924
15	74 44	12 19	9·99834	9·5802
19	83 13	13 11	0·01228	9·5748
23	91 56	13 48	0·02668	9·5766
27	100 32	14 7	0·04128	9·5861
31	108 52	14 6	0·05596	9·6026
April 4	116 38	13 52	0·07058	9·6252
8	123 47	13 27	0·08508	9·6527
12	130 16	12 55	0·09936	9·6831
16	136 4	12 21	0·11342	9·7162
20	141 28	11 49	0·12814	9·7520
24	145 54	11 15	0·14056	9·7846
28	150 8	10 47	0·15402	9·8196
May 2	154 18	10 24	0·16638	9·8513
6	157 14	10 1 S.	0·17878	9·8861

4. *Report on the erection of a Depot of Charts and Instruments at Washington city;* by Lieut. J. M. Gilliss, 1845.—A law authorizing the erection of a depot of charts and instruments for the navy, was passed by Congress during the session of 1841–'42. The site selected is in the southwestern part of the city of Washington, on the north bank of the Potomac. The ground was excavated to a depth of 8 feet, for the foundations of the walls and bases of all the piers, except that for the great telescope, which is 9 feet below the surface of the ground.

The central building is 50 feet square on the outside. It is two stories and a basement high, and is surmounted by a revolving dome 23 feet in diameter. There are four rooms on each floor, separated by passages 10 feet wide, crossing each other at right angles. The diameter of the great pier at the base is 15 feet, and it is solid to a height of 10½ feet, where the diameter is 12 feet. Upon this is erected a conical pier of hard burned brick, the diameter at the base being 12 feet, the height 28 feet; diameter at top 7 feet, and walls 3 feet thick. The pier is capped by New York flagging stone, on which rests the pedestal of the equatorial.

On the east and west sides of this edifice are wings, each 26 feet long, 21 feet wide and 18 feet high. There is also a wing to the south, 21 feet long, with the same breadth and height as the others. In the west wing is the meridian transit instrument, and the mural circle; in the east wing it is intended to place a meridian circle and a portable transit instrument, and in the south wing is the transit instrument in the prime vertical. There will also be a clock to each wing. The piers are of granite from Maryland. The pedestal for the great telescope is one block weighing about 7½ tons; that for the prime vertical transit weighs 11½ tons; and the axis of the mural circle rests upon a block whose weight is 3½ tons. The dome weighs about 4 tons; rests on six 32 pound balls, and may be revolved by a power of ten pounds.

The magnetical observatory is in the form of a cross, the arms being 70 feet long, 10 feet wide, and 10 feet high, and is entirely under ground, the roof being 5 feet beneath the soil. Four marble pillars are placed at the extremities of the cross, for the support of the instruments, and three others near the center for the reading telescopes and scale—the observer occupying a seat in their midst. No iron or steel was used in the construction of any part of this building.

The great refractor was made by Merz and Mahler, of Munich, and reached Washington in May, 1844. The object glass is $9\frac{6}{10}$ inches in diameter, with a focal length 15¼ feet, and the time occupied in perfecting it was nearly two years. The finder has an object glass $2\frac{6}{10}$ inches aperture, with a focal length of 32 inches. The hour circle is 15 inches in diameter, and reads by two verniers to 2^s; the declination circle is 21 inches in diameter and reads by four verniers to $4''$. The telescope is moved by a clock which may be detached at pleasure. The instrument is furnished with a filar-micrometer, having eight eye-pieces with magnifying powers from 100 to 1000. It is so arranged that the observer may have bright lines and a dark field, or bright field and dark lines; and the quantity of light is controlled at pleasure. There are two annular micrometers, and five ordinary eye-pieces, with powers from 150 to 750 times.

The cost of this telescope was $6000; its object glass alone being valued at $3,600.

The transit instrument was made by Ertel and Son, at Munich. Its object glass has an aperture of $5\frac{1}{2}$ inches, and a focal length of 88 inches, and was obtained from Merz and Mahler. The axis of the transit is 42 inches long. The telescope is formed of two conic frustrums of brass, so that the object and eye ends may be readily transposed. There are two circles eight inches in diameter for finders, reading by two verniers to 10″. The diaphragm contains seven vertical and two horizontal permanent wires, and a movable vertical wire. The cost of the instrument was $1480; the object glass alone $320.

The mural circle was made by Simms, of London, and was received in June, 1844. The circle is of brass, and is connected with the central portion by twelve spokes or radii. The whole is one cast. It is divided into spaces of five minutes each, upon a band of gold inlaid on the rim, or perpendicular to the plane of the circle. The telescope has an aperture of four inches, and a focal length of five feet. In its focus are seven vertical and one horizontal stationary wires, and a micrometer wire. Placed at equal distances round the circle are six reading microscopes. Five revolutions of the micrometer measure five minutes on the scale, and the heads are divided into sixty equal parts for seconds. Cost of the circle, $3550.

The transit in the prime vertical, was made by Pistor and Martius, of Berlin, and reached Washington in February, 1844. The axis is 42 inches long. The object glass of the telescope has an aperture of five inches, with a focal length of 78 inches. In the focus are placed two horizontal and fifteen vertical stationary wires, and one movable vertical wire. Cost of the instrument, $1750.

The comet seeker was made by Merz and Mahler. It has an object glass $3\frac{9}{10}$ inches in diameter, and focal length of 32 inches. It is mounted equatorially, has eye-pieces which magnify from 12 to 50 times, and cost $280.

Two astronomical clocks have been ordered, one of Mr. Charles Frodsham, London; the other of Mr. William C. Bond, of Boston. They cost $300 each.

The magnetical instruments.—The declinometer was made by Mr. Barrow, of London. The magnet bar is a rectangular parallelopiped, 12 inches in length, 0.85 inches in breadth, and 0.27 inches thick. It is suspended in a brass stirrup furnished with a mirror after the manner of Gauss. The suspension thread is composed of eight fibres of silk. The reading telescope has an aperture of 1·7 inches, and a focal length of 21 inches.

The bifilar magnetometer was also made by Mr. Barrow. It is constructed in the same general manner and of the same dimensions as the declinometer.

The balance magnetometer has also a needle 12 inches in length. It has a cross of wires at each end, attached by means of a small ring of copper. The axis of the needle is formed into a knife edge, the edge of which passes as nearly as possible through the center of gravity of the unloaded instrument. There is also a mirror above the knife edges of the needle, whose plane is perpendicular to the magnetic axis. The needle rests by its knife edges upon agate planes resting upon a marble base.

Fox's deflector, for the purpose of measuring the inclination and intensity, was made by Mr. George, of Falmouth.

The observatory is also furnished with a standard barometer by Newman; a dry and wet bulb thermometer; Daniell's hygrometer; self-registering thermometer; Osler's anemometer and rain gauge.

About 200 volumes, mostly of astronomical observations, were presented by different societies and astronomers of Europe, and 650 volumes were obtained by purchase, forming thus the nucleus of an astronomical library.

Thus, then, we have at last a naval, if not a national, observatory. As respects the number, dimensions, and probably also the quality of its instruments, it has few equals in Europe. The public are anxiously looking for the fruits of this noble establishment. May their reasonable expectations not be followed by disappointment.

5. *First Report of the Director of the Cincinnati Observatory*, Prof. O. M. Mitchell, 1845.—In May, 1842, the Cincinnati Astronomical Society was fully organized, and in June following, Professor Mitchell started for Europe to purchase a telescope. At Munich, he found an object glass of 12 inches aperture, which had been tested by Dr. Lamont, and pronounced one of the best ever manufactured. This was subsequently ordered to be mounted, and was purchased for $9437. The instrument arrived in Cincinnati in February, 1845. The corner stone of the observatory was laid by the venerable John Quincy Adams, in November, 1843. The observatory is 80 feet long and 30 feet broad, and is situated upon a lofty eminence to the east of the city proper. The front of the building presents a basement and two stories, while in the center, the building rises three stories in height. The pier is built of stone, and is grouted from its foundation on the rock to the top. The equatorial room is 25 feet square, and is surmounted by a roof so arranged as to be removed entirely during the time of observations.

The hour circle is 16 inches in diameter, and reads by two verniers to 2^s. The declination circle is 26 inches in diameter and divided on silver to 5′, reading by verniers to 4″. The instrument has five common eye-pieces, and nine micrometrical, with powers varying from 100 to 1400.

This observatory is the result of the private munificence of 700 or 800 citizens of Cincinnati, each of whom has contributed in sums of $25 to the funds of the society.

It is said that this noble telescope has disclosed the 'beds of lakes and rivers' in the moon. We may safely infer however, that these are *dry* rivers. If there was any water on the moon's surface, a portion of it would be evaporated and form an atmosphere about the moon, which would reflect light, and affect the duration of occultations of the stars. A ray of light entering the earth's atmosphere obliquely, is refracted more than half a degree, and it experiences the same effect in emerging from our atmosphere, so that the total deviation of a ray of light just grazing the earth's surface is more than a degree. If the moon had an atmosphere of the same density as the earth, and its centre was interposed between us and a fixed star, the star would not be concealed, but would be seen with scarcely diminished brightness three quarters of a degree from the moon's disc. If the moon had an atmosphere capable of supporting a column of mercury only *one fiftieth of an inch* in height, it would produce an amount of refraction in the occultation of a star which would long since have been detected. But no indications of refraction, however minute, have ever been perceived; hence we may safely infer that there is no river either on the 'hither' or further side of the moon.

To complete the outfit of the Cincinnati observatory, there is wanted a clock and transit circle, without which the great refractor will be comparatively useless to science. The citizens of Cincinnati have excited the admiration of their own countrymen and of Europe, by their liberal patronage of the sublime science of astronomy; and we doubt not that the view of the heavens through their noble telescope will amply repay them for all the sacrifices they have made.

As the subject of astronomical observatories is attracting increased attention in this country, and we are almost daily hearing of the purchase of new instruments, it may be well to give an extract from the catalogue of Merz and Mahler's refractors.

No. 1. Refractor 21 feet focus, 14 (French) inches aperture; price 42,000 florins. [The florin is about 40 cents.] This is the instrument furnished for the Russian observatory at Pulkova, and a similar one has been ordered for Cambridge observatory, in this country.

No. 2. Refractor 17½ feet focus, 12 inches aperture; price 30,000 florins. This is the one purchased for the Cincinnati observatory.

No. 3. 15 feet focus, 10½ inches aperture, price 22,000 florins.

No. 4. 13½ feet focus, 9 inches aperture, price 15,000 florins. This is the one purchased for the Washington observatory.

No. 5. 9⅔ feet focus, 7 inches aperture, price 8000 florins.

No. 6. 8 feet focus, 6 inches aperture, price 4800 florins. This is the size which has been purchased for the Philadelphia and West Point observatories.

No. 7. 6 feet focus, 52 lines aperture, price 2200 florins.

No. 8. 5 feet focus, 48 lines aperture, price 2000 florins.

All the preceding dimensions are French, which are greater than English measure. 12 French inches are equal to 12·79 English inches.

V. Arts and Manufactures.

1. *Effect of Heat on the Tenacity of Iron;* by Prof. W. R. Johnson, (from the Report on the strength of materials for steam-boilers, 1837.)—The following table exhibits the effect of heat on the tenacity of iron, both while actually hot and also subsequent to the application of a strain at high temperature. The comparisons are made on thirty two different specimens of iron, the origin of which is designated in the first column of the table. The page of the report of the sub-committee of the Franklin Institute, on the strength of materials for steam boilers, published in 1837, where the detail of the experiments is found, is given in the second column. The temperature at which either the "hot fracture" or the hot strain was made on each bar, and which produced the strengthening effect of "thermotension," is contained in the third column. The fourth contains the number of trials made on each specimen of iron to ascertain its strength in its ordinary state and temperature, as it came from the hammer or the rolls, and before being put under strain at a high temperature. Column fifth shows the number of times the specimen was broken or at least strained at the temperature marked in column third. Column sixth gives the number of fractures made on the specimen to obtain the average strength after being heated, strained and then cooled again to ordinary temperature. Columns seven, eight, and nine contain the absolute strength given in the three different states respectively. Column ten exhibits the per centage increase of strength by treatment with thermotension, and eleven the difference in strength between the iron at ordinary temperature in its original state, and that which it possessed while heated as in column third. In three cases only does it appear that the strength had been diminished by heating up to the point at which the trials were made. One of those trials was at 766°, one at 662°, and the third at 552°. The average temperature at which the effect was produced was 573·7°, at which point the eleventh column shows that the strength of thirty varieties of iron, was 5·9 per cent. greater than at ordinary temperatures, say at 60 or 80 degrees.

It also appears that the average gain of tenacity in thirty two samples of iron, by the process above mentioned, was 17·85 per cent., ranging from 8·2 to 28·2 per cent. It will be found on reference to my report to the Bureau of construction, equipment and repairs of the Navy Department, that the average gain of length of bolts of iron treated at the Washington Navy yard, by this same process, was 5·75 per cent., and the gain of strength 16·64, making together the gain of value 22·4 per cent. The addition of 5·75 to 17·85, gives 23·6 per cent. for the total gain of value. In many instances the experiments made at the Franklin Institute proved the gain of length to exceed 7 per cent. The report to the Bureau also confirms what had previously been observed, viz. that the total elongation of a bar of iron, broken in its original cold state, is from two to three times as great as the *same force* would produce upon it if applied at a temperature of 573°, which force will moreover not break the bar at that temperature.

Table exhibiting the effect of Heat on thirty-two varieties of Malleable Iron.

Name and origin of the specimen of iron tried.	Page of Franklin Institute Report, containing the trial.	Temperature of iron when proved hot.	No. trials for average ordinary strength.	No. of trials at high temperature.	No. of trials after heating & straining	Average strength in ordinary state and at ordinary temp'ture.	Strength exhibited while hot.	Average strength after applying thermo-tension.	Gain of tenacity per ct. by the treatment with thermotension.	Diff. per ct. between original strength and that shown when the bar was hot.
Salisbury, (Conn.) gun bar,	192	554	4	1	5	59,271	60,459	65,090	8.2	+ 2·0
Maramee, (Mo.) bar iron,	166	528	7	1	3	53,775	54,273	59,044	9·8	+ 0·9
Phillipsburg, (Pa.) wire,	158	500	4	2	4	79,720	80,488	84,187	10·4	+ 0·9
Ellicott's Baltimore boiler plate,	128	770	3	1	5	56,644	56,644	63,132	10·7	± 0·0
" " " "	130	662	4	1	7	58,899	58,181	64,820	10·9	− 1·2
Salisbury, (Conn.) gun bar,	202	550	3	1	7	59,654	60,323	66,638	11·7	+ 1·1
" " "	200	590	4	1	9	59,032	62,952	67,384	13·5	+ 6·6
Swedish bar iron,	184	530	2	1	3	58,012	59,775	66,334	14·3	+ 3·0
Nashville, (Tenn.) bar iron,	172	520	7	1	5	54,934	58,451	62,600	14·5	+ 6·4
Salisbury, (Conn.) gun bar,	206	572	5	1	10	58,305	58,895	63,558	15·0	+ 1·0
Ellicott's Baltimore forged bar,	118	394	1	1	1	57,182	63,322	65,960	15·3	+10·7
Spang & Son,* ham'd plate,	90	766	3	1	1	57,664	54,819	66,500	15·8	− 4·9
Blake & Co.* ham'd plate,	104	572	6	1	4	60,532	62,278	66,941	16·3	+ 2·8
Salisbury, (Conn.) gun bar,	194	580	4	1	5	55,977		65,883	17·0	no hot frac.
" " "	208	564	4	2	8	54,644	60,215	64,363	17·6	+10·2
" " "	204	576	5	2	5	58,299	64,278	68,988	18·4	+10·0
" " "	196	630	4	1	6	57,433	60,010	67,569	18·7	+ 4·5
English "best-best" cable bolt,	152	560	3	1	10	62,466		71,000	19·3	no hot frac.
Spang's Pittsburg ham'd plate,	86	552	2	1	3	56,762	55,932	62,736	19 4	− 1·4
Nashville, (Tenn.) bar iron,	178	560	7	1	6	52,729	58,534	62,127	19·5	+11·0
Mason & Miltenberger,* piled,	82	574	4	1	2	55,426	60,083	68,339	19·5	+ 8·4
Nashville, (Tenn.) bar iron,	174	562	4	1	2	52,194	59,623	62,433	19·8	+14·2
Ellicott's Baltimore boiler iron,	126	553	2	1	3	61,519	66,450	73,898	20·1	+ 8·0
Schaenberger's Pittsburg boiler,	114	630	1	1	3	53,803	56,159	64,926	20·6	+ 4·4
Maramee, (Mo.) bar iron,	164	564	5	1	9	49,974	52,158	58,126	20·6	+ 4·3
Nashville, (Tenn.) bar,	170	578	5	1	5	52,406	59,192	62,951	21·1	+12·9
Russia sable bar,	180	584	5	1	3	76,071	77,161	92,470	21·5	+ 1·4
Maramee, (Mo.) bar,	162	576	6	1	4	43,386	50,067	53,368	23·0	+15·4
Ellicott's hammered bar,	118	394	1	1	1	53,176	56,570	69,767	25·8	+ 6 4
Salisbury, (Conn.) gun bar,	198	575	3	1	6	52,873	60,988	66,685	26·6	+15·3
Maramee, (Mo.) bar,	160	574	5	2	4	45,586	51,437	58,252	28·1	+12·8
Blake's Pittsburg ham'd plate,	106	564	6	1	4	52,937	58,284	65,425	28·2	+10·1
	Mean,	573.7	129	36	153			Mean,	17 85	+ 5·9

* Of Pittsburg.

2. *A new Photogenic Paper;* by M. Gaudin, (Chemist, Aug. 1845, p. 363, from the Bull. de la Soc. d'Encouragement.)—A sheet of white paper is exposed for a minute to the vapor of hydrochloric acid; after which, a nearly saturated neutral solution of nitrate of silver is passed over its surface by means of a brush, (which must not be fastened by metal;) the paper is then allowed to dry, and the dry sheet is placed in the focus of the camera obscura; and on removing it, and wetting the paper with a nearly saturated solution of sulphate of iron, slightly acidulated with sulphuric acid, the image before invisible immediately appears. In order to fix the image, it must be well washed, first with pure water, and afterwards with water containing 10 per cent. of caustic ammonia. If the parts which ought to be white have a yellow tint, the paper, before being allowed to dry, must be washed in water acidulated with hydrochloric acid.

The image, of course, is reversed. In order to reproduce this image in its true position, it is placed upon a sheet of paper similarly prepared, and exposed to the action of light, until the edge of the paper (projecting beyond that upon which is the reversed image) becomes blackened; it is then washed in the solution of caustic ammonia, without treating it with sulphate of iron.

In order to reproduce the reversed images, they must be varnished, which removes the inequalities from the paper, and materially assists the operation. J. L. S.

3. *Improvement in Photography;* by W. H. Hewett, (Phil. Mag., Nov. 1845, p. 405.)—This improvement consists in using the vapor of ammonia as an agent to accelerate the action of light upon the plate. The effect is produced upon a simple iodized plate, but still more upon a plate prepared in the ordinary way, with both iodine and bromine. By this means, the author obtained impressions instantaneously in the sunshine, and in five to ten seconds in a moderate light; and he hopes to be able to take moving objects. It can be applied by exposing the prepared plate over a surface of water, to which a few drops of ammonia have been added, (sufficient to make it smell of ammonia,) or the vapor can be introduced into the camera during the action. In fact, the presence of ammonia in the operating room appears to have a good effect, as it also neutralizes the vapors of iodine and bromine that may be floating about, and which are so detrimental to the influence of the light upon the plate. J. L. S.

4. *Wood for supporting Rails in Railways.*—M. Boucherie renders wood for railways proof against decay, by saturating it, according to a method of his own, with either a sulphate of copper, or a double chloride of mercury and soda, or with chloride of calcium and pyroligneous

acid. He proposes to use other woods than oak, and states that his method increases the price of wood but four francs the stère.*

5. *Manufacture of Artificial Stone for Grinding, and other purposes;* by F. Ransem, (Chem. Gazette, Aug. 1845, p. 36.)—The method consists in cementing fragments of stone, by a soluble silicate of soda, and consolidating the mass by pressure. The cement is formed by dissolving 100 lbs. of crystallized carbonate of soda in 50 gallons of water, rendering the soda caustic by lime, and evaporating to 20 or 25 gallons: then place the solution in a boiler, with 100 lbs. of finely broken flints, or other siliceous material, and heat for 10 or 12 hours under a pressure of about 60 lbs. to the square inch, stirring it frequently. After this, the undissolved portion is filtered out, and the cement is ready for use; its degree of concentration may be varied by the addition of more of the siliceous material, or more water.

To make millstones, one part of powdered flint, or powdered pipe clay, and three or four of fragments of buhr-stone, or other suitable substance, are mixed with one part of the cement; the whole is subjected to heavy pressure in iron moulds, and afterwards is allowed to dry at the ordinary temperature for 24 hours; it is then put in a drying oven, and the temperature gradually raised to that of boiling water, and in this way completely dried. For stones of other kinds, granite, common sand, or any other similar material may be used, with one fourth to one sixth of the siliceous cement. By using very fine material, a coating for walls may be made. J. L. S.

6. *A new method of Blasting;* (Chemist, July, 1845, p. 310.)—M. Courbefaisse has found, that by enlarging the hole, for blasting, at bottom, either by chemical or mechanical means, much greater effect is produced by the powder, and the rock is lifted and rent, without being thrown to a distance. In a limestone rock, he uses hydrochloric acid for the enlargement of the hole required, applying it through a tunnel, in three or four successive doses. J. L. S.

MISCELLANEOUS INTELLIGENCE.

1. *Natives of Australia,* (Ethnography and Philology of the Exploring Expedition, by H. Hale.)—The natives of Australia are of the middle height, few of the men being above six or under five feet. They are slender in make, with long arms and legs, and when in good condition, their forms are pretty well proportioned. Usually however their wandering life, singular habits, and bad food, keep them extremely meagre; and as this thinness is accompanied by a protuberance of the abdomen, it gives to their figures a distorted and hardly human appearance.

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* The stère is equivalent to 35·317 cubic English feet.

Their color is a dark chocolate or reddish black, like that of the Guinea negro, but varying in shade so much, that individuals of pure blood are sometimes as light-colored as mulattoes. That which distinguishes them most decidedly from other dark skinned races, is their hair, which is neither woolly, like that of the Africans and Melanesians, nor frizzled, like that of the Feejeeans, nor coarse, stiff and curling, as with the Malays. It is long, fine and wavy, like that of Europeans. When neglected, it is apt of course to become bushy and matted; but when proper care is taken of it, it appears as we have described. It is sometimes of a glossy black, but the most common hue is a deep brown. Most of the natives have thick beards, and their skins are more hairy than those of whites.

The impression produced on the mind of a stranger by an intercourse with the aborigines, in their natural state, is that of great mental obtuseness—or, in plain terms, an almost brutal stupidity. They never count beyond four, or, in some tribes, three; all above this number is expressed by a term equivalent to many. Their reasoning powers seem to be very imperfectly developed. The arguments which are addressed to them by the white settlers, for the purpose of convincing or persuading them, are often such as we should use towards a child, or a partial idiot. Their superstitions evince for the most part this same character of silliness. Some are so absurd as to excite at once laughter and amazement. The absurdity, it should be remarked, is not the result of an extravagant imagination, as with some portion of the Hindoo mythology, but downright childishness and imbecility. One instance, given on the authority of Mr. Threlkeld, missionary at Lake Macquarie, will probably be sufficient. In a bay, at the northwest extremity of that lake, are many petrifactions of wood, which the natives believe to be fragments of a large rock that formerly fell from heaven and destroyed a number of people. The author of this catastrophe was an enormous lizard of celestial origin, who collected the men together, and then caused the stone to fall. His anger had been excited against them by the impiety which they had evinced, in killing vermin (lice) by roasting them in the fire. Those who had killed them by cracking, were speared to death by him with a long reed which he had brought from the skies. When all the offenders were destroyed, the lizard reascended to heaven, where he still remains.

Although living constantly in what appears to us a most degraded state, and frequently suffering from actual want, they are nevertheless extravagantly proud. The complete personal independence to which they are accustomed, gives to their ordinary demeanor an air of haughtiness and even of insolence. They appear to have a sense, or it may almost be termed an instinct, of independence, which disposes them on all occasions to assert their equality with the highest. They frequently observe on being asked to work, "White fellow works, not black fellow; black fellow gentleman."

It is not true, as has been frequently asserted, that the natives have no idea of a Supreme Being, although they do not allow this idea to influence their actions. The Wellington tribe, at least, believe in the existence of a deity called *Baiamai*, who lives on an island beyond the great sea to the east. His food is fish, which come up to him from the water when he calls to them. Some of the natives consider him the maker of all things, while others attribute the creation of the world to his son *Burambin*. They say of him, Baiamai spoke, and Burambin came into existence. A being, beyond question, of the creation of Australian imagination, is one who is called in the Wellington dialect *Wandong*, though the natives have learned from the whites to apply to him the name of devil. He is an object not of worship, but merely of superstitious dread. They attribute all their afflictions to his malevolence. If they are ill, they say Wandong has bitten them. No one can see this being but the *nuyargir* or conjurors, who assert that they can kill him, but that he always returns to life. He may however be frightened away by throwing fire at him, and no native will go out at night without a firebrand to protect him from the demon. At the Murruya river, the devil is called *Tulugal*. He was described to us by a native as a black man of great stature, grizzled with age, who has very long legs, so that he soon overtakes a man, but very short arms, which brings the contest nearer an equality. This goblin has a wife, who is much like himself, but still more feared, being of a cruel disposition, with a cannibal appetite, especially for young children. It would hardly be worth while to dwell upon these superstitions, but that they seem to characterize so distinctly the people, at once timid, ferocious and stupid, who have invented them.

2. *Origin of the Polynesians;* (ibid.)—The Polynesians extend over the Pacific Ocean, from the Sandwich Islands on the north to New Zealand on the south, an interval of 3700 miles, and occupy all the groups east of a line between these distant islands, excepting the Feejees. Mr. H. Hale in his account of the ethnography of those seas, shows satisfactorily that the original site or mother country from which migration took place, to the other parts of this extent of ocean, is the region of the Navigators (or Samoan) and Friendly Islands. The Society Islands and Rarotonga were settled direct from Samoa. The Gambier Islands from Samoa through Rarotonga. The Marquesas from the Friendly Islands and Samoa through Tahiti. The Sandwich Islands from Samoa through the Marquesas and Tahiti. New Zealand from Samoa. The Kingsmills from Samoa to the southeast, and from Ban-

abe, one of the Philippines, (called Ascension Island,) to the northwest. The island of *Savaii* is the largest in the Samoa group; and this name is retained in the traditions of all the groups, and is even given to some of the islands of these groups, as *Hawaii* at the Sandwich Islands. The course of argument on this subject will be presented in the next number of this Journal. The Friendly Islanders appear to have reached their islands through the Feejees; the natives of this last mentioned group are apparently a mixture of the Papuan with the Polynesian.

The Polynesians, as is well known, belong to the Malay race of the East Indies. Mr. Hale suggests some reason for inferring that they may be traced back to the island of Bouro, to the west of New Guinea.

3. *Cosmogony of the Polynesians;* (ibid. p. 24.)—Two stories are prevalent among the Samoans with regard to the creation of the world, or at least of their islands. Both attribute the work to their great god Tangaloa. According to one account, while the god was fishing, his hook caught in the rocks at the bottom of the sea, and in drawing it up he raised with it the whole group of Samoa. The other story represents him as forming the land by throwing down large stones from the skies, from which his daughter, Tuli, (snipe,) made the different islands. She afterward planted them with vegetables, one of which was a kind of vine, from whose stem a god named Ngai formed the first man, by marking out the body and members of a human being.

In Tonga the first of these stories is generally received. They add to the Samoan account, that when the god Tangaloa had raised the islands to their present altitude, his hook broke and left them in that situation; otherwise they would have continued to rise until they formed one great land. The New Zealanders and Tahitians have the same accounts of their islands having been drawn up by a god while fishing, and both give to this god the name of Maui, which, as we have before shown, is but another appellation for Tangaloa. The Tahitians have, besides, other stories, one of which,—to the effect, that the islands are fragments broken off from an immense rock,—has already been given. The word for rock is *papa*, which is also the name of the wife of Taaora, and from this source some confusion may have arisen, as some of the traditions relate that the islands were born of Taaora and Papa. The Hawaiians, according to Mo'o-olelo, before quoted, have the same story, that the islands were born of Papa, the wife of Atea, the progenitor of the human race.

The belief so generally prevalent, of the islands having been raised by a divinity, from the bottom of the sea, will appear natural enough if we consider the circumstances and character of the people. The situation of their islands, mere specks of land, surrounded by what must have appeared to the inhabitants an interminable ocean, and the fact that the Polynesians are emphatically a nation of fishermen, would be sufficient to suggest the idea. When the priests, to whom the religion and mythology were especially committed, were called upon to account for the formation of the land which they inhabited, they would of course refer it to their great god Tangaloa or Maui, and no other mode would be so likely to occur to them as that by which they themselves had frequently drawn up fragments of coral rock from the bottom of the sea.

The fact that two or more stories are sometimes current on the same group, shows in what light they are regarded by the natives; not as articles of their religious creed, which they are bound to believe, but merely as traditions handed down from their fathers, which, though respectable for their antiquity, may, after all, not be true. Their opinions on this subject therefore differ widely from those which they hold with regard to the existence and power of their gods, of which none of them entertain a doubt.

4. *Cannibalism among the Polynesians*, (ibid., p. 37.)—The Polynesians may, without injustice, be called a race of cannibals. In New Zealand, the Hervey group, the Gambier Islands, the Paumotu Archipelago, and the Marquesas, the practice is, or was, universal, and is confessed by the natives with no apparent feeling of shame. In the Navigator, Friendly, Society, and Sandwich Islands, though not common, it was in former days occasionally practiced, and (which is the most important point) was not regarded with any great horror. By some it has been supposed that this custom originated in the fury of revengeful hostility; by others, in the cravings of hunger during seasons of famine. But the natives of New Holland, who are quite as ferocious as the Polynesians, and who frequently suffer severely from the want of food, are not cannibals.

There is in the minds of most men, savage as well as civilized, a certain notion of sanctity attached to the dead body of a human being,—a feeling of dread and repugnance at the idea of touching or disturbing a corpse,—which no effort can altogether vanquish. This feeling, however, appears hardly to exist among the people of these islands, as is apparent in several of their customs. It will be sufficient to mention two. The Polynesians do not, usually, like many savage tribes, torture their prisoners to death; nor are they wont, as a general thing, to preserve any part of the body of a slain enemy as a trophy,—though this is sometimes done. But it is their chief object, and especial delight, to secure the corpse, for the purpose of practicing upon it every horrible disfigurement which the imagination can devise. Mr. Ellis relates several of the modes in use among them, and remarks that some are too revolting to be described. No other race of savages has evinced this disposition to the same extent.

The other custom relates to the disposal of their dead. With most barbarous tribes, as well as civilized nations, the natural repugnance to the presence of a corpse is shown in the desire to put it away as soon as possible "out of their sight." The Polynesians have little or none of this feeling. In some islands, as in Tahiti and Nukuhiva, the bodies of the dead are (or were) exposed on stages near the dwellings of the living; in others, as at the Navigator and Sandwich Islands, they are buried either near or in the houses of their friends, and the skulls, and sometimes other bones, are afterward taken up and preserved as relics. At New Zealand, the body is placed on the ground in a sitting or crouching posture, and enclosed within the two halves of a canoe; this is set in the midst of their villages, which are often made unapproachable to a foreigner by the scent of putrefaction.

To a people like this, in whom the salutary awe of death is so completely extinct, who are naturally of a bloodthirsty disposition, and whose religious belief has nothing of a moral or elevating tendency, there is evidently no restraint but that of custom to deter them from cannibalism. The practice may have commenced in some excess of revenge, or in a season of famine; but it is now continued purely for the gratification of a depraved appetite. On this point the testimony of the natives themselves is distinct and positive; and as they are aware of the abhorrence with which the act is regarded by the whites, there can be no good reason for disbelieving them.

Of the four Oceanic races, the Polynesians and Melanesians are, generally speaking, addicted to cannibalism; while among the natives of Australia and Micronesia it is, so far as we are informed, unknown.

5. *Antarctic Continent.*—The *Pagoda*, despatched from England under the command of Lieut. Moore, to explore the Antarctic regions, between the meridian of Greenwich and 120° E., has found proof throughout of the existence of the Antarctic Continent, which they called *Victoria's* Land. The magnetic observations commenced by the *Erebus* and *Terror* have been completed, and the position of the magnetic pole exactly ascertained.

6. *Potato-disease.*—According to information received by Boussingault from M. Joachim Acosta, of Bogota, the potato-disease is well known on the plateau of Bogota, and prevails especially in rainy years, or in damp places. It is well known that the potato is indigenous to that region. The people use the tainted potatoes, after removing the diseased part.

7. *Expedition to Siberia*, (L'Institut, November, 1845, No. 619, page 397.)—The Siberian Commission have recommended a new expedition into Siberia and the Frozen Seas of the North, with special reference to the mean temperature of the regions, and

their animals and plants. Middendorf had ascertained that the temperature of the soil at Turuchansk (obtained by digging pits) was near zero, C., (32° F.,) whilst the isothermal line on Mahlman's chart of the temperature of the air at this place, is that of −10° C. (14° F.) The great disparity renders this a point meriting particular attention; and observations in pits or wells are recommended, and series of such observations along meridians, to ascertain whether there is a decrease of temperature in the soil on going north.

8. *Ascension of the Snowy Peak, Kasbek, Persia*, in 1844; by Dr. Kolenati, (L'Institut, Nov. 1845, No. 619, p. 397.)—The peak of Kasbek is 2308 toises in elevation above the sea, or 2077 above the village of Tifflis. Dr. Kolenati succeeded in making the perilous ascent, and has published an account of it, describing the different glaciers of Kasbek, their courses, the cause of the descent of one from Desdaroki to Dhagaur, and the attendant circumstances; also the rocks and vegetation, including much that is interesting in geology and physics.

9. *Tycho-Brahe;* (L'Institut, Nov. 1845, No. 619, p. 400.)—Prof. Heiberg, who is engaged in a work on the life and works of Tycho-Brahe, which will be published in the course of the year coming, is reported to have discovered in the ruins of the castle and observatory of Tycho, on the Swedish island Hveen, many utensils and implements used by this astronomer, in constructing his astronomical instruments. Besides these relics, there were also found several manuscripts in Latin, with Tycho-Brahe's signature, some treating on different topics of astronomy, and others containing reflections upon the events of the time, and also a few poetical fragments.

10. *Geology of Brazil;* (L'Institut, 1845, No. 621, p. 412.)—Dr. Lund is continuing his geological researches in the province of Minas Geraes, in Brazil, and has found in the marly clays of the calcareous caverns, remains of several animals, among which are two species of horses, and a colossal panther.

11. *Vesuvian Meteorological Observatory;* (L'Institut, Nov. 26, 1845, No. 621, p. 416.)—A new meteorological observatory has just been established on the summit of Vesuvius. It was inaugurated at the time of the late convention of the Italian Scientific Association, at Naples, and is placed on the celebrated mountain called Santissimo Salvatore.

12. *The Congress of German Naturalists*, whose last session was held at Nuremberg, will take place next year at Kiel, in the duchy of Holstein. The general agent for that session is M. Michaels, professor of chemistry at the University of that village.

13. *Electrical Lady.*—The electrical lady, particulars of whose singular case are given in vol. xxxiii, p. 394, of this Journal, has lately died.

We ascertain from Mr. W. Hosford, the physician who attended her, that her disease terminated in tubercular phthisis. From the time of the previous communication respecting her, to her death, she had repeated evidence that the singular faculty of electric excitement remained with her, though much enfeebled. It was exhibited only during periods of ill health, and then but for a short time. This is the testimony of the lady during her last sickness.

14. *Nuttall's Cabinet of Minerals for sale.*—This cabinet contains about two thousand choice specimens, generally not less than three inches square, and usually well crystallized. It is quite extensive, and is the result of many years' collection, purchase and exchange. Application can be made to G. W. Carpenter, No. 301 Market street, Philadelphia, where terms and further particulars can be obtained.

15. *Cabinet of Minerals of the late Dr. J. P. Young, of Edenville, N. Y., for sale.*—This cabinet contains one to two thousand specimens of well selected minerals, both foreign and domestic, particularly those from the localities of Orange Co., N. Y., and Sussex Co., N. J. Any information desired regarding it, may be obtained of Samuel D. Holly, of Edenville, who is desirous of disposing of it as early as possible.

16. The Highland Agricultural Society (Scotland) have awarded their premium of £50 sterling, (proposals for which were issued two years ago,) for the best essay on the chemical constitution of *oats*, to our young countryman, JOHN P. NORTON, Esq., of Farmington, Ct., who has been for the past two years a pupil in the laboratory of Prof. James F. W. Johnston, at Edinburgh.

BIBLIOGRAPHY.

1. *Paléontologie Universelle des Coquilles et des Mollusques*, with an Atlas, representing all known species of fossils. *Mollusques vivants et Fossiles, ou description de toutes les espèces de Coquilles et des Mollusques, classeés suivant leur distribution geologique.*—The above are the titles of two works which M. Alcide D'Orbigny proposes to publish, the one, a general work on Palæontology, and the other, confined to Molluscs, both fossil and recent. The *former* will constitute eight volumes in 8vo, and be accompanied with 1500 octavo plates; price of each number, containing 20 plates and the corresponding text, 6 francs. The *latter* work will extend to 10 volumes in 8vo, with 300 engraved plates; each number containing 5 plates and 5 leaves of text, 3½ francs; or 5 francs, with the recent species colored. Subscription is desired at Gide et Cie., Libraires-editeurs, rue des Petits-Augustins, 5, Paris.

M. d'Orbigny is desirous of obtaining the various publications, by American authors, bearing upon the subjects of the above mentioned works, and offers in exchange his own publications, a catalogue of which is given on our advertising sheet. The value and high character of these publications are too well known to require comment from us. His Paléontologie Française is one of the best and most elegant works on this branch of science hitherto published. From 1826 to 1834, d'Orbigny was engaged in his travels in South America, and in that period traversed the continent from Patagonia to the equator, over the prairies and the mountain ranges. He has since been president of the Geological Society of France.

2. *Essai d'une Carte Géologique du Globe terrestre;* by A. Boue.—This chart, by one of the first geologists of France, gives a general view of the geology of the globe: its dimensions are about 3 feet by 2½. It was presented to the German Association, or "Reunion" of Naturalists, which met at Gratz, in September, 1844. It is published by J. Andriveau-Goujon, rue du Bac, No. 17, under the auspices of the Geological Society of France.

3. *Annales des Sciences Naturelles.*—A new series of this valuable scientific journal was commenced in 1844, under the direction of M. Milne Edwards, for Zoology, and Ad. Brongniart and J. Decaisne, for Botany. The typography, engravings, and the character of its memoirs, are of the highest order. Four volumes are issued annually, two devoted to Zoology, and two to Botany.

4. *First Annual Report of the Geology of the State of Vermont,* 1845; by C. B. Adams, *State Geologist, Burlington.*—We are glad to find that the public authorities of this State have at last awakened to the importance of having a geological survey of their valuable territory. So many of these useful labors have already been performed, that the path of inquiry is now plain, and if followed with zeal and discrimination, will yield important results. The present report of Professor Adams, is designed mainly to inform the Governor of the State and the Legislature, of the object and scope of the undertaking. As the appointment of a State Geologist in Vermont, is only a recent event, but little labor can have been done in the field; but we trust ample means will be provided for the accomplishment of the undertaking.

5. *New York Scientific Reports.*—The scientific reports under the direction of the State of New York, which have thus far appeared, are as follows:—

Zoology, by James E. De Kay—
  1 volume in quarto on Quadrupeds, with 33 plates.
  1 " " on Birds, with 141 plates.
  2 " " on Reptiles and Fishes, with 79 plates.
  1 " " on Mollusca and Crustacea, with 53 plates.
Mineralogy, 1 volume, by L. C. Beck.

Geology, 4 quarto volumes, severally by W. W. Mather, E. Emmons, James Hall, and Lardner Vanuxem.

Two volumes are yet to appear on the Fossils of the various rocks, by James Hall. This subject is a vast one; and it is alike honorable to the state and of great importance to the science of geology, that it promises to be carried out with the same completeness which has thus far characterized the whole series of Reports.

Besides these, there are to be two volumes on the Botany of the State by Dr. J. Torrey, and one on Agriculture, Insects injurious to vegetation, &c. by E. Emmons.

6. *Essay on Guano*, by J. E. TESCHEMACHER, pp. 51, 8vo, Boston; describing its properties and the best method of its application in agriculture and horticulture, with the value of importations from different localities, founded on actual analyses and on personal experiments upon numerous kinds of trees, vegetables, flowers, and insects in this climate.

7. *Reports on the Bear Mountain Railroad;* by EDWIN F. JOHNSON and WILLIAM R. CASEY, Civil Engineers: and *on the Coal and Iron Ores of the Bear Valley Coal Basin;* by JAMES HALL, with maps, profile, and geological cross section. Also an appendix, containing the charter of the company and statistics of the coal trade of the United States and Great Britain. pp. 88, 8vo. New York, 1845.

8. *Boston Journal of Natural History*, vol. v, No. 2, 1845.—Dissection of a Sperm Whale, and other Cetaceans, by J. B. S. Jackson.—Musci of Eastern Massachusetts, by J. L. Russell.—Descriptions and figures of the Araneides of the United States, by N. M. Hentz.—Descriptions of some new Insects of the United States, by J. L. Le Conte.—Plants from Texas, with descriptions of some new species, by. G. Engelmann and A. Gray.—Descriptions of the Fishes of Lake Erie, the Ohio River, and their tributaries, by J. P. Kirtland.—New Fossil Footmarks, by J. Deane.—New species of Marine Shells of the United States, by H. C. Lea.—New Shells from the coast of Africa, by A. A. Gould.—Note on Melocactus viridescens, by J. E. Teschemacher.—Notice of two species of Linguatula, by J. Wyman. This number contains 14 plates beautifully executed.

9. *Proceedings of the Academy of Natural Sciences for November and December*, 1845, (vol. ii, No. 12.)—p. 299, New Fossil Footprints, by A. T. King, (see notice of the same, p. 268 of this volume.)—p. 300, A new species of Parus (P. septentrionalis) from the Upper Missouri, by E. Harris.—Description of new species of Coleoptera of the United States, by F. E. Melsheimer.—p. 318, Examination and analyses of the alluvial soil of the Nile, from Korosco in Nubia, by W. R. Johnson.

This number closes the second volume of the Proceedings of the Academy; the title-page and *Index* will be issued with the first number of the third volume. By a notice accompanying the number, the public are informed that complete copies of the Proceedings may be procured for $1 50 a volume. The Journal of the Society, which now embraces *eight* octavo volumes, with numerous plates and illustrations, may be obtained at the reduced price of $2 per volume for the whole set, or $2 25 for a single volume, by addressing Mr. WM. S. VAUX, chairman of the committee of publication, No. 145 Arch street, Philadelphia.

10. *The Southern Journal of Medicine and Pharmacy;* edited by J. LAWRENCE SMITH, M. D., and S. D. SINKLER, M. D., Jan., 1846, No. 1, Vol. i, semi-monthly. Charleston: Burges & James, publishers.—This new medical journal is published in numbers of 120 pages each, neatly printed and very well edited. The bibliographical notices and reviews, abstracts from American and foreign journals, and new facts in pharmacy, are all uncommonly full and judiciously selected. The chemical part of the work could not be in better hands, and if continued as it is begun, its value to medical men will make it very generally read in all parts of the country.

11. *The Buffalo Medical Journal;* edited by AUSTIN FLINT, M. D.—Nine numbers of this monthly journal of medicine have appeared. Each number contains 24 pages, and includes much original matter, besides excerpts and bibliographical notices.

CORRECTION.

In the notice of Sullivant's *Musci Alleghanienses*, on p. 71 of the last number of the Journal, an important mistake and omission occurs, which the editors are desired to correct in the ensuing number. The proper diagnosis and habitat of *Syrrhopodon? excelsus* has been left out altogether, and that of a very different moss, viz. *Leucophanes? Leanum* substituted for it. To make the proper correction, all that stands under No. 170, on pp. 71, 72, should be stricken out, and the following introduced in its place. A. GR.

170. SYRRHOPODON? EXCELSUS (*n. sp.*).

Caule ascendente innovando-ramoso; foliis e basi subvaginante recurvis auguste lanceolatis costatis complicato-carinatis in medio margine reflexis apicem versus argute serratis punctulato-areolatis. . . . . .

HAB. summo in cacumine montis *Grandfather*, Carolinæ Septentrionalis, arboreus.

172. LEUCOPHANES? LEANUM (*n. sp.*).

Densissime cæspitosum, fastigiato-ramosum; ramis corpusculorum (fol. abortiv.) congestis acervulis terminatis; foliis lineari-subulatis convoluto-canaliculatis ecostatis subsecundis nitidis albido-viridibus, e compluribus stratis tubulosarum cellularum conformatis. . . . . .

HAB. in sylvaticis depressis intér montes *Alleghanienses*, ad arborum truncos putredine decompositos, necnon in Ohione, haud infrequens, at semper sterile: beat. *T. G. Lea*, scrutator muscorum in vicinia urbis *Cincinnati* indefensus, primum detexit.

POSTSCRIPT.

1. Since the body of this number of the Journal was printed, we have received an interesting letter from Charles Lyell, Esq., dated Feb. 4th, at Claiborne, (Ala.) addressed to B. Silliman, Jr., from which we make the following extracts:

"As you expressed a wish to receive as early a notice as possible, of some of the results of my geological explorings in the South, I will send you a brief statement of several conclusions to which I have come since I entered Georgia and Alabama.

"1st. I have visited some of the principal localities where the bones of the gigantic Cetacean (the Zeuglodon) have been discovered in Clarke County, Ala., in the fork of the rivers Alabama and Tombeckbee, and find the geological position of the bones to be every where the same, namely, in the white tertiary limestone of the Eocene period, corresponding in age to that of the Santee River, in South Carolina, or of Burke County, in Georgia, or that of the upper part of the celebrated bluff of Claiborne, in Alabama.

"2d. The beds in which the remains of the Zeuglodon occur, are above the level of those Claiborne deposits, so well studied and described by Mr. Conrad in 1832–3, as containing several hundred perfectly preserved species of lower tertiary shells.

"3d. Part of the head of the Zeuglodon and vertebræ, extending to a length of 30 feet, were procured by Mr. Koch in 1845, at a place which I visited, 4½ miles southwest from Clarksville, Ala., in company with Mr. Pickett, who assisted in the exhumation made by Mr. Koch. But the main body of the vertebræ, (as I learn from the same gentleman, and other persons,) which entered into the skeleton exhibited in the United States in 1845, under the name of Hydrarchos, were procured in Washington County, Alabama, fifteen miles distant, in a direct line, from the place where the head was discovered.*

"4th. I have information of more than forty other localities, where separate bones of the same huge animal have been met with, in Clarke and Washington counties, all in such perfect condition, and each so bulky and so distant from the rest, that I can hardly doubt their having belonged to as many distinct individuals.

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* Another correspondent (S. G. Houston, Esq.) gave us a confirmation of Mr. Lyell's statement, under date of Washington County, Ala., Nov. 1st, 1845. Mr. H. says that the fossils were found, a bone here and a bone there, scattered over a space of 25 miles by 10 or 12.—*Eds.*

"5th. The age of the nummulite limestone of Alabama, seems to have been involved in considerable obscurity, it having been commonly referred to the secondary period, or considered as an upper cretaceous formation, or as possibly intermediate in age between the tertiary and secondary strata. After visiting the neighborhood of Suggsville, Macon, and Clarksville, Ala., I am persuaded that it is a tertiary limestone newer than all the beds of the well known Claiborne bluff, and lying immediately above the calcareous rock in which the Zeuglodon occurs. It is therefore by no means in the lowest part of the Eocene system of the South. Hitherto I have always met with it in hills considerably higher above the sea, than the top of the bluff at Claiborne, a circumstance which, in a region where the stratification is horizontal, would imply a newer deposit, even if the sections near Suggsville and Clarksville, showing actual superposition, had been less satisfactory. I did not meet with the limestone in question in the bluff at Claiborne, which I have no doubt is owing to the fact that the calcareous strata are cut off at the top, before they extend upwards into the nummulitic beds.

"6th. The conclusion last stated, will make it necessary in future to omit from the list of cretaceous fossils, such species of shells as have been referred to the secondary formations, simply on the ground of their occurrence in the nummulitic limestone. The fossils which I met with most abundantly in the latter, were the Nummulites Mantelli, (Morton,) and Pecten Poulsoni. I also found in the lower part, Pecten perplanus, Ostræa panda, and Plagiostoma dumosum, a large species of Cypræa, a Lunulite, and other corals.

"7th. The shale of the tertiary white limestone country of Alabama, is covered, like that of the Savannah River in Georgia, with river deposits of red clay, with quartz gravel, fine yellow, white, and pink sands, white porcelain earth, and occasionally chert and clay with sand intermixed. In many places in Georgia, where the buhr-stone occurs in this series, I have found in it distinct casts of Eocene testacea and corals, and I have shown, in the Proceedings of the Geological Society of London, the manner of its superposition to the subjacent calcareous beds in Scriven County, Georgia, which is equally applicable at Claiborne and in Clarke County, Alabama. Whether this upper deposit in Alabama be Eocene, and identical in age with that of Georgia, as I suspect, I am unable as yet positively to prove by the evidence of organic remains, although I have met with some faint impressions of shells and silicified wood in Clarke County.

"8th. The underlying Eocene or white limestone series, has a very undulating surface, on which the newer beds, many hundred feet thick, were deposited. The inequalities having been thus removed, and the hollows filled up, the existing valleys were excavated in both deposits. From this disposition of the beds, it happens that a deep cut in one place may pass exclusively through the limestone, and then at another, in the immediate neighborhood, through the incumbent newer strata. At Claiborne itself the bluff at the new landing consists of the calcareous formation about 150 feet thick, with a capping of 20 feet of the newer deposit, while about a mile lower down in the same bluff the appearances are reversed, and the upper formation occupies more than 100 feet of the higher part of the bluff, the calcareous beds cropping out from beneath. The section given by me in the Quarterly Journal of the Geological Society, No. 4, p. 438, in reference to the Jacksonboro' beds in Georgia, will enable you to understand this arrangement."

2. *Discoveries with the Great Refractor at Cincinnati.*—In an interesting communication published in the Daily Atlas (Cincinnati) of Feb. 11th, 1846, Prof. Mitchell, the able director of the Cincinnati Observatory, announces that he has devoted all the time he could command, to an examination, with the noble instrument pertaining to that establishment, of a zone in the heavens, extending from 15° to 40° of Southern Declination. The number of new double and multiple stars already thus discovered amounts to one hundred and fifty five. Of those of the former class, the most interesting is *Antares*, a star of the first magnitude in *Scorpio*, which on the 13th June, 1845, Prof. M. detected to be accompanied by a minute stellar companion, distant only 1·7″, and this discovery he has confirmed by repeated observation. There is every reason to suppose that this splendid and often observed star, had never before been seen double. Of the latter class, is a triple star in the *Pleiades*. When first discovered, several months since, the three stars were precisely in the same straight line. By an observation of Feb. 9, 1846, it appeared that "the line drawn through the two minute stars, no longer passed through the centre of the larger star, and shows conclusively a rapid motion in the minute star next to the principal one." We shall wait with much interest for the many important discoveries yet to be revealed by the aid of this powerful instrument.

The plates designed to accompany Mr. Conrad's article on Eocene Fossils, at page 206 of this number, did not arrive from Philadelphia in season to be inserted in their proper place. They will be issued in our next.

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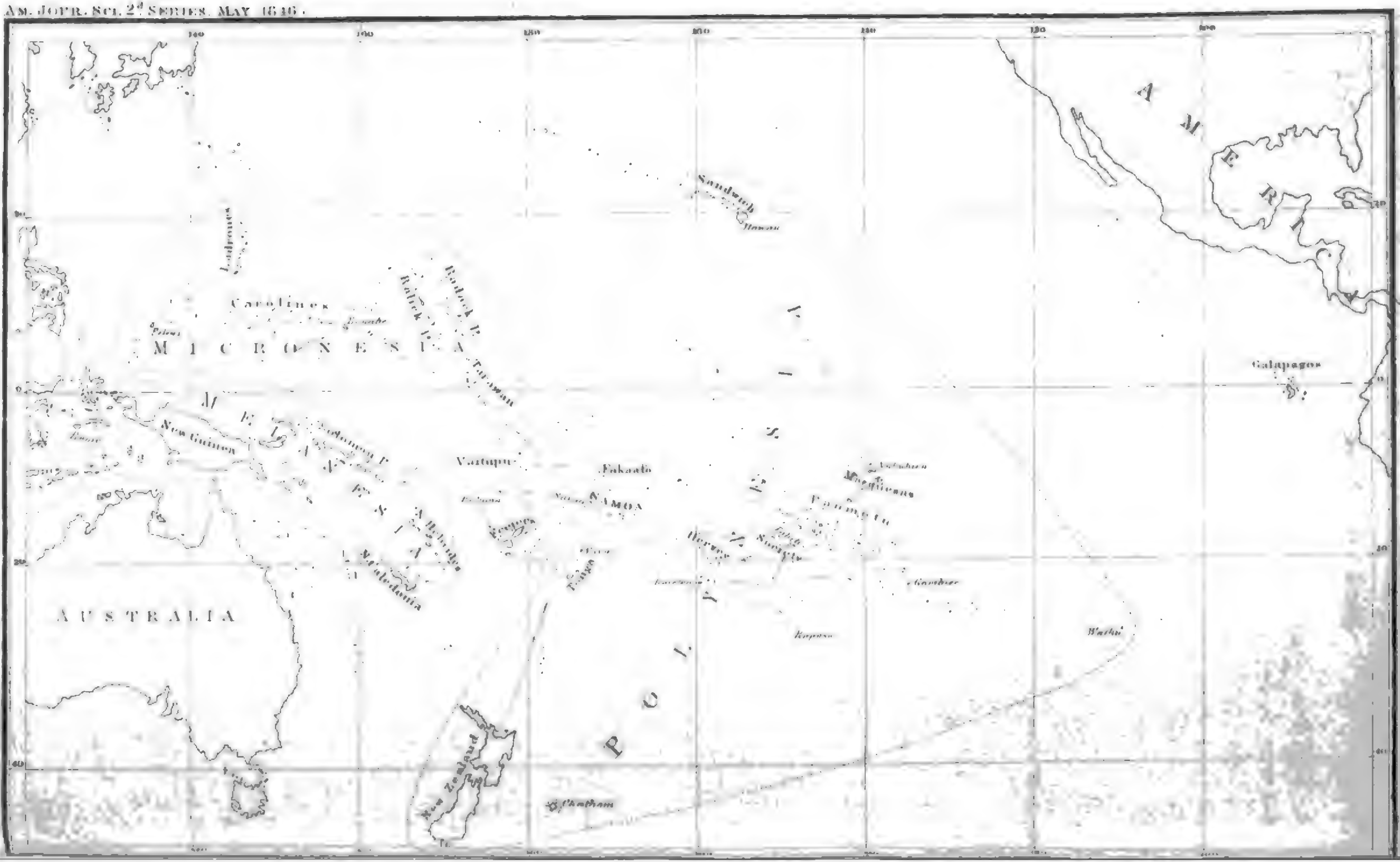

THE

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[SECOND SERIES.]

Art. I.—*Migrations in the Pacific Ocean*, from the volume on the Ethnography and Philology of the U. S. Exploring Expedition under Charles Wilkes, U. S. N.; by Horatio Hale, Philologist of the Expedition. 1846.

The work by Mr. Hale from which we gather the following facts and conclusions respecting the migrations of the islanders of the Pacific Ocean, bears evidence throughout of great labor, directed by a clear and philosophical mind. The first 225 pages are devoted to Ethnography, or an account of the customs, religion, civil polity and origin of the nations of the several countries and islands visited by the Expedition. The remaining 440 pages comprise the Philology of the same regions. The various dialects of Polynesia are treated of under the general head of a Comparative Grammar of Polynesia, followed by a Polynesian lexicon. The languages of the Feejee Islands, the Kingsmills, Rotuma, Australia, and northwest coast of America, and some dialects of Patagonia and southern Africa, come next under consideration. We feel assured that a glance at the work will excite surprise in all at the amount of information collected, and pleasure at the system and perspicuity with which the whole is presented.

In common with many others, we had expected but little more than a few imperfect vocabularies from this department in the Expedition. But this view arose from ignorance of the advantages for collecting information which the philologist would find at his command. On every island visited, interpreters were at hand, for the shipping of the seas had scattered sailors through all the Pacific groups; and even in the imperfectly known Feejees, there was an Irishman who numbered forty years among these natives. Besides, in very many of the dialects, the languages had been written out and works printed by the missionaries of those seas. By these aids, even the intimate structure of the languages could be thoroughly studied. A philologist was needed to visit the wide-spread groups of the Pacific, gather up the information to be obtained from different sources, and present a general and comprehensive view of the languages of the ocean; and for this task Mr. Hale was well fitted: we can bear testimony from personal knowledge, to his industry, his calm judgment, and his careful scrutiny in the collection of facts; as to the rest, the work speaks for itself. It is an honorable monument alike to the author, the Expedition, and the country.

The Polynesians spread over the greater part of the Pacific Ocean. Twelve hundred miles north of the equator lie the Sandwich Islands, one of the Polynesian groups, and two thousand two hundred miles south of the line, another of the same—New Zealand. Between these limits, as will be seen on the accompanying chart, or rather between the equator and the latitude of New Zealand, there are the Friendly Islands, the Society Islands, Hervey Islands, Austral Islands, Gambier or Mangareva group, Marquesas or Nukuhivan, Paumotu Archipelago, Union or Fakaafo group, and some other scattered islets. The population as stated by Mr. Hale is as follows:—

Samoan or Navigator Islands,	56,000
Friendly or Tongan Islands,	18,000
New Zealand,	150,000
Society or Tahitian Islands,	20,000
Hervey group,	14,000
Austral Islands,	1,000
Gambier or Mangareva group,	2,000
Paumotu Archipelago,	8,000
Marquesas or Nukuhivan Islands,	20,000
Sandwich or Hawaiian Islands,	100,000
Union or Fakaafo group,	1,000
	380,000

The whole number, adding the scattered islands, is far below half a million.

The languages spoken at these several groups are closely related dialects of one language, a branch from the Malay of the East Indies. In no instance do they differ more decidedly than the Spanish and Italian languages, and usually the dissimilarity is much less. We cite the first few paragraphs, commencing the chapter on Orthography, to illustrate some of the analogies.

"The elementary sounds proper to the Polynesian languages are fifteen in number, namely, the vowels *a*, *e*, *i*, *o*, *u*, and ten consonants, *f*, *k*, *l*, *m*, *n*, *η*, *p*, *s*, *t*, *v*."*

"The only dialect, so far as is known, in which all these letters are found, is that spoken in the two groups of *Fakaafo* (Union) and *Vaitupu*. In the other dialects some of these letters are dropped entirely, and others changed.

"In *Samoan*, the *k* is dropped, its place being indicated merely by a hiatus or catching of the breath, as *ali'i* for *aliki*, *'a'ono* for *kakono*.

"In *Tongan*, the *k* is retained, but the *s* is changed to *h*, as *hahake* for *sasake*, *aho* for *aso*. The *t* in this dialect, when it precedes *i*, has a sound not unlike the English *ch*, or like *ti* in *Christian;* the missionaries have represented this sound by a *j*, as *jino* for *tino*, (pron. *chino*.)

"The *New Zealand* dialect changes the *s* to *h*; the *l* to *r*; the *v* to *w*; and the *f* before *a* and *e* to *w*; before *o* and *u* to *h*; and before *i* commonly to *w*, but sometimes to *h*: as *heke* for *seke*, *waka* for *vaka*, *ware* for *fale*, *vetú* for *fetú*, *hoe* for *foe*, *huri* for *fuli*, *witi* for *fiti*, and *hia* for *fia*. If two *f*'s occur in the same word, preceding an *a* or an *e*, the first *f* is usually changed to *w*, and the second to *h*; as *waha* for *fafa*, *wehe* for *fefe*.

"The dialects of *Rarotonga* [Hervey group] and *Mangareva* [Gambier group] lose both the *f* and the *s* entirely, and have *r* instead of *l*; as *are* for *fale*, *ae* for *sae*.

"The *Paumotuan* has the same elements as the New Zealand, except that the *f* is sometimes heard in the place of the *w*. Many of its words assume peculiar forms unlike those of any other dialect, as *mateu* for *matou*, *mauηa* for *maua*. The *k* is sometimes introduced in words where it does not properly belong, as *reko* for *reo*, *kakuenei* for *akuenei*.

"The *Tahitian* dispenses with both *k* and η; the *s* is changed to *h*; the *f* before *a* and *e* is commonly though not always retained; before *i* and *u* it is replaced by *h*; the *r* also is used instead of *l*; as *ari'i* for *aliki*, *rai* for *laηi*, *fa'a* for *faka*, *hou* for *fou*.

"In *Hawaiian* [Sandwich Islands], *f* and *s* are changed to *h*, η becomes *n*, *w* is used for *v*, (though the sound is properly intermediate between the two,) and the *k* is dropped, as in Samoan and Tahitian; as *hale* for *fale*, *lani* for *laηi*, *wa'a* for *vaka*.

"The *Nukuhivan* [Marquesas] varies in different islands, and even in different districts of the same island. In Tahuata and the other southern islands the *f* is retained; the η becomes *n*, and the *k* is frequently omitted. In Nukuhiva, and the rest of the northern cluster, the *f* is changed to *h*, the *k* is retained (except at the beginning of words, where it is omitted or retained at the pleasure of the speaker,) and ŋ becomes *k*, except with the people of one district, (the Taipis,) who give it its true sound. In all the islands the *l* (or *r*) is omitted, or at least is very rarely used. Thus we have in Tahuata *fiti*, *fae* (or *hae*,) *hana* for *haŋa*, and *Havai'i* for *Savaiki*; in Nukuhiva, *hiti*, *hae*, *haka*, (or with the Taipis *haŋa*,) and *Havaiki*."

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* The vowels are pronounced as in Italian, *ah*, *ay*, *ee*, *o*, *oo*. The letter η, (a Greek letter, but much resembling that used by Mr. Hale,) has the sound of *ng*.

The facts here quoted, while they exhibit some of the relations of the dialects, are important in fully understanding Mr. Hale's arguments. Without farther introduction we give an abstract of his results, by citations from the eighty pages over which the subject extends, though we find much difficulty in making a selection from his succinct and highly interesting chapters.

The discussions relate not to their primitive seat, which is acknowledged to be the East Indies, but to the point of radiation in the Pacific ocean, or the island or group first inhabited, "and which bore to the rest the relation of the mother country to its colonies."

"The first result of a careful investigation, is to produce the conviction that the progress of emigration was from west to east, and not in the contrary direction. This conclusion may be deduced merely from an examination of the comparative grammar and vocabulary of the various dialects. We see in those of the western groups many forms which are entirely wanting in the eastern tongues; others which are complete in the former are found in the latter defective, and perverted from what seems evidently their original meaning."

"Other comparisons serve to confirm this general deduction. We find in the west a comparatively simple mythology and spiritual worship, which in the east is perverted to a debasing and cruel idolatry. The fashion of tattooing, which, in Samoa and Tonga, is intended to answer the purposes of decency, has degenerated elsewhere into a mode of ornament. Other facts of a similar nature might be mentioned, but it will hardly be thought necessary. One circumstance however must be noted, which becomes apparent in this investigation. The people of the Tonga or Friendly group, though belonging to the Polynesian family, form a class apart from the rest. This is seen in their language, which differs strikingly, in several points, from the others, especially in the article, the pronouns, and the passive voice of the verb. Several of their customs are, moreover, peculiar, such as that of infant sacrifice, of cutting off a finger to appease the gods, their mode of canoe making, &c. It is evident that these islanders have received modifications in their language and usages, from a source which has not affected the rest. We shall for the present leave this group out of the question in our discussion, and recur to it hereafter."

The possibility of navigating canoes eastward, opposite to the course of the trades, is an established fact, and a supposed difficulty in this view of their migrations is set aside. During a large part of the winter months, westerly winds prevail over the tropical regions and extend as far east as the farthest limits of the Paumotu Archipelago. The Tonga people in their intercourse with the Feejees, which is still sustained, take the trades in going to the Feejees, a distance of two hundred and fifty miles, and wait for the westerly winds to carry them back. Among instances of voyages to the east "we have the remarkable case of Ulea, in the Caroline Archipelago, who was found by Kotzebue, in 1817, on the island of Aur one of the Radack chain, to which he had been driven in a canoe with three companions, a distance of nearly 1500 miles due east. Beechey in like manner found on Barrow Island, in the Paumotu Archipelago, some natives of Chain Island, who had been drifted by the westerly winds 600 miles."

> "On our arrival at the Navigator Islands, we there saw the newly published work of the Rev. John Williams, entitled, "A Narrative of Missionary Enterprise in the South Sea Islands." Of the mass of information which it contains, I was especially struck with that relating to the peopling of Rarotonga, the inhabitants of which consider themselves to have descended in part from emigrants from the Navigator group. At another of the Hervey Islands, *Aitutaki*, the inhabitants believe that their ancestors ascended from a region *beneath*, termed *Avaiki*. This account called to mind a similar tradition of the Marquesans, who gave to the lower region the name of *Havaiki*. (Stewart's Voyage to the South Seas, i, 273.) All these terms are the precise forms which the name of the largest of the Navigator Islands (*Savai'i*) would assume in the different dialects. It seemed probable, therefore, that by following this clue, the different tribes of Polynesia might all be referred back to their original seat. On communicating these views to Mr. Williams, (but a few weeks before his lamented death,) he informed me that he had long entertained the opinion that the Samoan Islands were the source of the population of the other groups of Polynesia."

Mr. Hale's opinion, thus supported, was afterwards sustained by all the facts which his investigations brought to light, and also by incidental statements in the writings of former voyagers. He remarks upon one peculiarity of the Samoa group, that it is the only one in all Polynesia, in which the natives have a general appellation for the group—the term *Samoa*. This word in Malay signifies *all;* in process of time it seems to have lost its meaning as an adjective and became a mere appellative; as we use the word *Union*, in speaking of the United States. The Samoan word for all, is *uma*, which means properly *finished*, *complete*. The changes which the word *Savaii* would undergo in the several dialects, are given as follows:—

" Original form,	Savaiki.
Samoan dialect,	Savai'i.
Tahitian,	Havai'i.
Sandwich Island,	Hawai'i.
Rarotongan and Mangarevan,	Avaiki.
Nukuhivan,	Havaiki.
New Zealand,	Hawaiki."

Mr. Hale commences his review of the Pacific islands, with the *Society* group.

" As our attention was not drawn to this subject of investigation (that which connects the Polynesians with Savaii) until after we left this group, we are unable here to add any thing to what has been given by others. Fortunately this is amply sufficient for our purpose, and, as already remarked, has the great advantage of having been obtained and published without the possibility of a reference to any hypothesis like that now advanced. Mr. Ellis, in his Polynesian Researches (vol. ii, p. 234, American edition) says:—' *Opoa* is the most remarkable place in Raiatea; of its earth, according to some of their traditions, the first pair were made by *Tii* or *Taaroa*, and on its soil they fixed their abode. Here *Oro* held his court. It was called *Hawaii;* and as distant colonies are said to have proceeded from it, it was probably the place at which some of the first inhabitants of the South Sea Islands arrived.' As there is no *w* in the Tahitian language, (at least in the usual orthography,) it is here evidently written instead of a *v*. In another part of the same work, (vol. i, p. 105,) the author in treating of the origin of the Society Islanders, inclines to refer them to the Sandwich Islands, his principal reason being, that ' in some of their (the Tahitian) traditions, *Hawaii* is mentioned as the ancient name of *Opoa*, and *Oro*, who is by some described as both god and man, as having two bodies or forms, or being a kind of connecting link between gods and men, is described as the first king of Hawaii, or Opoa in Raiatea.' The Tahitian *v* is frequently sounded like *w*, and Mr. Ellis here evidently chooses the latter element, in order to show more clearly the resemblance, or rather identity, of the name, with the *Hawaii* of the Sandwich Islands. He was not at that time aware of the existence of a *Savaii* in the west;

had he been so, we may conclude that the reason which led him to derive the Society Islanders from the northern group would have induced him to refer both the Hawaiis to that source.

"Cook, in the history of his first voyage, (vol. iii, p. 69,) comparing the New Zealanders with the South Sea (i. e. Society) Islanders, observes that 'they both have a tradition that their ancestors, at a very remote period of time, came from another country; and according to the tradition of both, the name of that country is Heawije.' There is no *j* in either the New Zealand or Tahitian language. It may be a mistake, made in printing or copying, for *g*, the hard sound of which is frequently given by the Polynesians to their *k;* in this case *Heawije* would be the English orthography for the New Zealand word *Hawaiki.**

"But the most important testimony is that furnished by a chart drawn by *Tupaia*, (or *Tupaya*,) the native who accompanied Capt. Cook in his first voyage, and published by J. R. Forster, in his 'Observations made during a Voyage round the World.' It contains the names of all the islands known to Tupaia, either from having visited them, or by tradition. The extent of information displayed in it is truly surprising. We find every important group in Polynesia, except the Sandwich Islands and New Zealand, laid down, though not accurately, yet with a certain attention to bearings and distances, which enables us to identify them. What gives the chief value to the chart, is the fact, that, at the time it was drawn, more than half the islands which it contains were unknown to Europeans, and of those which had been discovered, the native names of very few were ascertained.

"Much confusion has been made in the chart by a mistake of those for whom Tupaia drew it. Knowing that *toerau* in Tahitian signified the north (or northwest) wind, and *toa* the south, they concluded naturally that *apatoerau* and *apatoa* were names applied to the corresponding points of the compass; whereas *apatoerau* signifies in fact, the point towards which the north wind blows, i. e. the south, and *apatoa* for the same reason the north. But not understanding this, they have, so far as these two points are concerned, reversed the chart completely, and it is in fact, printed upside down. But not content with this, it is apparent that these gentlemen (Capt. Cook, Mr. Banks, and Lieut. Pickersgill, whom Forster mentions as having obtained the chart) overlooked Tupaia while he was drawing, and suggested corrections, which his idea of their superior knowledge induced him to receive against his own convictions. This is clear, from the fact that all the groups and islands with which the English were not acquainted, are laid down rightly, according to the real meaning of *apatoerau* and *apatoa*, but wrong according to the meaning which those gentlemen ascribed to the words; while the islands whose position they knew, (the Marquesas and Paumotus,) are placed exactly as they should be, according to their mistaken meaning, but altogether out of the proper bearings when these are rightly understood. This, of course, makes great confusion, which can only be rectified when its origin is perceived.

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* The Polynesian letters *ai*, together, have the same sound nearly as *i* in *wine*.

"The westernmost group on this chart consists of eight islands, with compound names, all beginning or ending with *hitte*, as *Hitte-potto*, *Teamaroo-hitte*, &c. *Hitti* is the form which the Samoan word *Fiti* (*Feejee*) would take in Tahitian. One of these islands, *Ohiteroa*, answering to *Viti-levu*, has been removed from its proper place, as will be shown hereafter, by the same sort of correction as was applied to the Marquesas and Paumotu groups.

"To the east of this row of islets is another still larger, with the names *Weeha*, *Rotooma*, *Heavai*, *Ooporroo*, *Wouwou*, *Tootooerre*, and *Ouwhea*.* These are evidently *Uiha*, (one of the Habai cluster.) *Rotuma*, *Savaii*, *Upolu*, *Vavau*, *Tutuila* and *Uea*, (Wallis's Island.) The first and last from the similarity of names, seem to have become confused together; and Vavau is laid down out of its place,—but there is reason to believe that it was formerly considered as belonging politically to the Navigator group, to which it approaches nearest of any of the Friendly Islands. It should be observed that on many of the principal islands Tupaia made brief descriptive observations, which are given by Forster. *Heavai* is laid down five or six times the size of any other island, and Tupaia stated that it was larger than Tahiti, adding this remarkable observation,—'it is the father of all the islands.'

"Combining these various traditions, we shall probably be thought justified in supposing that the first settlers of the Society Islands came originally from the Samoan group, and landed or established themselves at the place now called *Opoa*, on Raiatea, which they named *Havaii* after the principal island of their native country. *Oro* (or more properly Koro) may have been their chief at the time of migration. Concerning the probable period at which this occurred, we shall offer some considerations in another place.

"Additional evidence that the earliest Tahitian traditions are of Samoan origin may be derived from the work of Mr. Moerenhout, (formerly American consul at Tahiti,) entitled, 'Voyages aux Iles du Grand Océan,' in which we find an ancient mythological code, obtained from an old Tahitian priest, which the author justly esteems of much importance. Its value is perhaps even greater than he supposed. It relates the creation of the world and of the inferior deities, as accomplished by Taaroa. The first part informs us that Taaroa existed from the beginning, and that he formed the world from his own substance. It concludes as follows :—

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* These words are written by Cook according to English orthography, while those in the following sentence have the orthography which is now used in the Pacific. Uiha in Polynesian is pronounced *weeha;* Upolu, *oopoloo,* or *ooporroo* in different dialects; Uea, *oowea;* Vavau, *vahvow.*

Mr. M.'s orthography.	*Native orthography.*	
Taaroa te paari	Taaroa te paari	Taaroa the wise
fanau fenoua hoaïi;	fanau fenua Hawai'i	produced the land Hawaii,
hoaïi noui raa	Hawai'i nui raa	Hawaii great and sacred,
éi paa no Taaroa	ei paa no Taaroa	as a shell (body) for Taaroa,
té oriori ra fénoua	tei oriori ra fenua	who created (or vivified) the world.

" That by *hoaïi*, Mr. Moerenhout means to spell (in the French orthography) *hawaii*, is evident from the fact that on page 558 of this volume, he requoted the passage which we have given above, and spells this word *ohaii*, and on page 221 of the second volume, he remarks, that *Ohaii* is the name of the largest of the Sandwich Islands, (*Hawaii.*) Mr. Moerenhout translates *ohaii* by *universe*, and it is likely enough that this may be the meaning now attached to it by the Tahitian priests. The second part of the ode continues the work of creation, and ends with the line '*épau fenoau no hoaïi*,' (or *e pau fenau no Hawaii*,) finished is the land of Hawaii. The third part relates the origin of the gods, who were born of Taaroa and his wives, after the creation of *ohaii*, and ends with '*tei moua iri té atoua Roo aravi na é éroto épou fanau ouporou*,' which should, perhaps, be, '*tei mua iri te atua Roo a rave na ei rotopu fanau Uporu*,' the god Roo remained in front and seeing that which was within, produced Uporu. This version is obscure and may not be altogether correct; but *fanau ouporou*, like *fanau fénoua hoaïi*, can hardly be mistaken. Upolu is the second of the Samoan Islands, nearly equal in size and importance to Savaii. There can be little doubt that this is an ancient Polynesian mythos, relating to the supposed origin of the Navigator Islands, and that it was brought from thence by the first emigrants to Tahiti, where it has probably undergone only such alterations as the gradual change in the language rendered necessary.

Mr. Hale next takes up the Nukuhivan or Marquesas Islands; and shows both by tradition, customs and language, that they have a double origin, the northern cluster having been settled by natives from the Friendly Islands, and the southern, from Tahiti. He mentions the belief among the latter, first ascertained by Mr. Cook, " that the land composing their islands, was once located in *Havaiki* or regions below—the place of departed spirits—and that they rose from thence through the efforts of a god beneath them." Commodore Porter heard from the Nukuhivans the tradition "that *Oataia* with his wife *Anamoona* came from Vavau eighty eight generations back, (reckoned in the family of Gattanewa himself,) and brought with them bread-fruit and sugar cane, and a great variety of other plants."

"Allowing for the present, the ordinary estimate of thirty years to a generation, it will give us two thousand six hundred and forty years since the arrival of Oataia from Vavau. It seems probable however that the first part of the royal genealogical list of Nukuhiva will be found like that of Hawaii, to be merely mythological; in which case the foregoing computation will require a corresponding correction, and the time elapsed since the settlement of the island will be considerably diminished."

The Sandwich Islands by a similar course of argument, are traced back through the Marquesas to Tahiti and Samoa. The word *Tahiti* means a *foreign country* in the Hawaiian language, and appears to point to some former knowledge of an island of that name, which was afterwards lost. Although ignorant of the Society Islands, "*Nukuhiva* and *Fatuhiva*, two of the Marquesas Islands are mentioned in their traditionary songs, as among the places visited by voyagers from Hawaii in former days." The Sandwich Islands are nearly 2000 miles from the Marquesas, on the other side of the equator; yet this long journey must have been performed by these savages; and moreover they carried with them dogs and pigs, as is evident from their traditions, and also from the breed of these animals being the same as in the other groups. The word Hawaii, given to one of their islands, is the Savaii of Samoa, an island of similar character in features and size.

The Hawaiians reckon up *sixty seven generations* since the migration from the Marquesas took place, and this genealogy forms a kind of verse, in triplets, the father, wife and son, (afterwards his successor) in each line.

"It might be doubted whether the natives could remember with accuracy so far back; but this doubt would cease on hearing one of them recite the genealogy in question. As given in the native history, called the Moo-olelo, it stands as follows,—beginning with the second king, the son of Watea and *Hoohotutalani.*

Husband.	Wife.	Child.
O Haloa.	Hinamanouluae.	O Waia.
O Waia.	Huhune.	O Hinanalo.
O Hinanalo.	Haunuu.	O Nanatehili, &c.

"But in the native recitation, as we have heard it, the words *tane* husband, *wahine* wife, and *tamaiti* child, are introduced after each name in the respective columns, thus—

O Haloa te tane,	O Hinamanouluae ta wahine,	O Waia te tamaiti.
O Waia te tane,	O Huhune ta wahine,	O Hinanalo te tamaiti, &c.

This, it will be seen, makes of it a species of verse, with, in fact, a greater approach to rhythm than most of the native poems. Accordingly the recitation is made in a kind of chant, to a regular tune, and any person who can retain in his memory a song of a hundred lines can have no difficulty in remembering this genealogy."

"It is to be observed that this is not, properly speaking, a list of kings, but merely of generations. In most cases, which frequently happened when two or more brothers succeeded one another on the throne, their names are given in the column of children. Thus *Liloa*, the eleventh in a direct line before Taméhaméha, had two sons, *Hatau* and *Umi*, of whom the first succeeded him, but was deposed for his tyranny, and the kingdom transferred to Umi. Both of these names with those of their respective mothers are given in the genealogy, but the former only among the children." "This explanation is necessary because the number of years to be allowed to a generation will be at least double that which we should assign to a reign." "Allowing thirty years to a generation, and supposing the list to be a correct one, we should have for the time that has elapsed since the settlement of the Sandwich Islands, about *two thousand* years.

But Mr. Hale goes on to state—

"Though there is no doubt of the ability of the natives to preserve a genealogy of this length, several circumstances incline us to question its entire correctness, and to doubt whether the first 23 names be not entirely supposititious. In the first place, the name of the king at the head of the list, O Watea, is precisely the same in pronunciation, with the Oataia of the Marquesans, (the orthography only being different.) The name of his wife is Papa, of whom it is said, 'she was the mother of all the islands.' This is the same name and the same tradition that the Tahitians apply to the wife of their great deity, Taaroa. It is further related by the Hawaiians that Watea and Papa had a deformed child, whom they buried, and from it sprang the *taro*-plant; the stalk of this plant was called *haloa*, and this name was given to their son and heir who suceeded them. This fable is evidently derived from the Nukuhivan story that the children of Oataia were named after the various plants which he brought with him from Vavau. Thus we have, in the commencement of the Hawaiian history, a singular mixture of Marquesan and Tahitian traditions. The twenty second king was *Atalana*, being the name of the god who supports the island of Savaii. He had four children, all of whom were named *Maui*, with some epithet appropriated, in other groups, to a deity. The youngest, *Maui-atalana*, succeeded him, and to him are attributed the same deeds that the Tahitians relate of their great deity *Maui*,—another name or manifestation of Taaroa. He was succeeded by Nanamaoa, from whom the real history of the islands seems to commence.

"The probability is that the Sandwich Islands were first peopled by emigrants from the Marquesans, of the mixed race which is there found. When, after a time, the inhabitants had become numerous, and some family was raised to supreme power, it became an object to trace the pedigree of the sovereign as far back as possible. After ascending as far back as their recollections would carry them—perhaps to one of the first settlers—till they reached an ancestor whose paternity was unknown, they made him, according to the usual fashion in such cases, the son of a god, *Maui*. This god was represented as the son of another deity, Atalana, and not satisfied with this, they added on as many names as they could recollect of the genealogy of the Marquesan kings, mixed with Tahitian deities and personified qualities. Thus the first name is, as above stated, the Nukuhivan *Watea;* the fourth is *Hinanalo*, a word which means *desire* in all the dialects except the Hawaiian; the tenth is *Manatu*, which means *memory* in the Samoan and Tongan languages; the eleventh is *Tahito* or *ancient;* the twelfth and thirteenth are *Luanuu* and *Tii*, two of the principal deities of Tahiti, belonging to the class which they term *hanau-po*, 'born of night.' Moreover, the wives of the first five kings are said not to have been different persons, 'but only different names of *Papa*, as her soul inhabited sundry bodies by transmigration,' which sufficiently shows that this part of the genealogy was looked upon as merely mythological.

"If this opinion be thought correct, it will be necessary to deduct twenty two generations from the list, (one of the twenty three kings having been a brother of the preceding,) which will leave for the whole number forty five. Multiplying this by thirty, we have thirteen hundred and fifty years from the commencement of the Hawaiian records, (and perhaps from the settlement of the country, though that is uncertain,) to the succession of Tamehameha; or reckoning to the present date, about fourteen centuries."

Farther confirmation of the origin of the natives from the Marquesas is drawn from some peculiarities of language; for example, "the Marquesas and Hawaiian are the only dialects which use the proposition *ma* before the locative adverbs;" "as a plural sign to denote a company or party the Tahitian has *pue;* the Nukuhivan (or Tahuatan) changes it to *poe*, like the Hawaiian," &c.

The *Rarotongans* or *Hervey Islands*, as well as the natives of Aitutaki consider *Avaiki* [Savaii] to be the country *beneath*, from which the first man, *Mumuki*, ascended to look for food. Throughout the Pacific, as Mr. Hale states, the same word means leeward, westward and below. A similar use of the words up and down with reference to opposite points of the compass is common to most, if not all languages. The trade winds at the Hervey Islands blow usually from the southeast, and Savaii which lies to the northwest is therefore nearly as possible "below" them. The traditions of the islanders refer their origin to two canoes of natives, one from an island to the westward called *Manuka* (the name of one of the Samoan islands) and the other from *Tahiti;* and the opposite sides of the island which they settled bear to this day the name of the leader in each, the former being called after Karika, Ngati-Karika, and the latter after their chief Tangiia Ngati-Tangiia. Moreover the Tahitians have traditions of Tangiia as a great navigator. We only glance here at Mr. Hale's arguments, and pass on to the

Gambier or Mangareva group, situated about a thousand miles to the eastward of the Society Islands.

"In the manuscript vocabulary of the Mangarevan dialect, which I owe to the kindness of M. Maigret, formerly missionary to this group, is found the following definition: '*Avaiki*, bas, en bas; *ko runga tenei, ko avaiki tena*,—ceci est le haut, cela est le bas.' From this it would appear that Avaiki, which in the Hervey Islands, is used to signify the region beneath, has come to denote, in the Gambier group, simply *below*, or *that which is below*. Examples of similar changes are not uncommon in the other dialects. At the Navigator group the wind which blows from the direction of the Tonga Islands (i. e. from the south) is called the *Tonga* wind. At the Hervey and Society Islands, this same word (*tonga* and *toa*) is used as the general term for south wind.

"A genealogy of the kings of Mangareva, drawn up by a native pupil of M. Maigret, with a few of the traditions respecting them, offers some points of considerable interest. The number of kings whose names are given is twenty seven. The first was *Teatumoana*, a name which means 'Lord of the Sea.' From him, the history says, 'all the inhabitants of the land are descended. He had no father, or perhaps he was a foreigner.' From him the line continues unbroken till the ninth king, *Anua;* he was succeeded by his son-in-law, *Toronga*, the name of whose father was not known. He was not, it appears, acknowledged by many of the chiefs, and a civil war ensued. One of the principal rebels named *Uma* was worsted, and, it is said, 'took refuge on the sea, and fled to a foreign land.' Afterward Toronga was killed by another chief, who endeavored to obtain his body in order to eat it; but the son of the murdered king secreted his father's corpse and buried it. The name of the son and grandson of Toronga are given, but their reigns must have been very short—perhaps merely nominal—for one of the chief combatants in the civil war succeeded finally in gaining the supreme power. His name was *Koa*, the thirteenth on the list, and from him the reigning sovereign derives his authority. His principal opponent, *Tapau*, fled to a foreign land, or abroad. After this follows an account of the numerous dissensions which took place in the different reigns, and the annalist remarks, 'formerly they fought much; formerly they ate each other.' The twenty second king, *Temangai*, was deposed and obliged to flee abroad. The usurper *Teitiou* succeeded, 'but his reign was short; he was conquered suddenly.' His name, it should be remarked, does not appear in the list—which shows, with several other circumstances, that it is in fact a genealogy, and not a complete enumeration of all who have held the sovereign power. The present king, *Maputeva*, is the fourteenth in a direct line from *Koa*, who gained the supremacy after the death of Toronga, the son-in-law of Anua, the eighth in descent from Teatumoana. The son and grandson of Toronga may be omitted, in which case it will appear that twenty five generations, or seven hundred and fifty years, have elapsed since the arrival of the first colonists. Therefore, if we suppose, as all the circumstances indicate, that they came from *Rarotonga*, they must have left that island about four generations, or one hundred and twenty years, after it was settled. This would account for some of the peculiarities in the dialects of Mangareva. The only points of any importance in which it differs from the Rarotongan are, first, in the use of *raŋa* instead of *aŋa*, to form the participial noun, as *te ope raŋa* for *te ope aŋa*, the act of finishing; and secondly in the use of *mau* as a plural prefix. In both these points it resembles the Tahitian. Now if the Rarotongan emigrants who settled in Mangareva, came, as is most probable, from that side of Rarotonga which faces toward the latter group, (i. e. the eastern side,) they were of Ngati-

Tangiia, or Tahitian party, and may at that time, have preserved some peculiarities of their original tongue which were afterward lost in Rarotonga, on a more complete intermixture wiih the *Ngati-Karika*, or Samoan party.

"In the foregoing traditions, the existence of cannibalism at a very early period will be noticed, as also the custom with conquered chiefs, of betaking themselves to the open sea to escape the vengeance of their adversaries. It was in this manner that *Temoe* or Crescent Island, a coral islet which lies about thirty miles to the southeast of the Gambier group, was peopled between sixty and seventy years ago. A defeated party fleeing from Mangareva, were drifted to this island, and remained there with their descendants, till the arrival of the Catholic missionaries, who, hearing of their situation, sent for them and restored them to their original homes. This well authenticated fact shows the manner in which most of the South Sea Islands have probably received their first inhabitants."

We have followed Mr. Hale sufficiently far to show the character of his argument, and shall but briefly notice the remaining pages. At the Paumotus, there is the same evidence with regard to the origin of the present inhabitants. Yet he remarks that they have an element in their language which indicates a commingling with some different race. At New Zealand, it is the traditionary belief that the first nations came from *Havaiki*, a country to the east, and the names of the canoes and first emigrants are retained by them. From the variations in the dialect from the original type, it is inferred approximatively that the settlement of New Zealand took place nearly at the same time with Tahiti, or probably not less than 3000 years ago. The names for the months in different dialects, for the winds, and for numerals, affords confirmation of the general conclusions adduced. With regard to the Tonga Islands, he finds reason for tracing them direct from the East Indies through the Feejee group, and attributes some of the characteristics of the Feejee natives to a partial mixture of Malaisian with the original Papuan of those islands. Much that is interesting on this point might be cited.

The Kingsmill or Tarawan Islands, both by tradition and language are connected with the Samoan on one side and with Banabe, one of the Philippine Islands on the other.

These various conclusions are laid down on the chart, (a reduction of Mr. Hale's,) which accompanies this article. All the various groups are seen to trace their origin more or less directly to the Samoan or Tonga Islands.

But the question comes up, may the Polynesians be traced any farther back in their history? The following paragraphs from the close of the discussion, offer at least a probable conjecture.

> "That the Polynesians belong to the same race as that which peoples the East Indian Islands is, at present, universally admitted. If any doubt had remained on this point, the labors of Wm. Von Humboldt and Prof. Buschman, would have been sufficient to set it at rest. Having traced all the principal tribes of Polynesia back to the Samoan and Tongan groups, it next becomes a question of interest, how far the information which we now possess will enable us to verify the supposed emigration of the first settlers in these groups from some point in the Malaisian Archipelago. From the almost total ignorance in which we yet remain of the dialect spoken in the eastern part of this archipelago, our means of forming a judgment are very limited. Nevertheless we may venture to offer a conjecture, based upon such an amount of evidence as may seem to bring it at least within the bounds of probability.
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> "The nations of Tonga and Samoa as has been before stated, refer the origin of their race to a large island, situated to the northwest, called by the former *Bulótu*, by the latter *Pulótu* and *Purótu.* As the *l* and *r* are used indifferently in these dialects, it would be doubtful which was the proper spelling; but the Feejeans, who distinguished between these two elements, have borrowed this and many other traditions from their eastern neighbors, and call the island in question *Mburótu.* Hence we may conclude that *Burótu* or *Purótu* is the correct form. Now the easternmost island inhabited by the yellow Malaisian race, in the East Indian Archipelago, is that called on our maps *Bouro* or Booro. It lies west of Ceram, which is occupied in the interior by Papuans and on the coast by Malays. Apart, therefore, from any resemblance of name, if we derive the Polynesians from that one of the Malaisian islands which lies nearest to them, we should refer them to the above mentioned Bouro."

After some additional facts and observations on this subject, Mr. Hale concludes by suggesting that the syllable *tu* may have the force of "sacred" or "divine."

> "It must be recollected that the natives of Samoa and Tonga, look upon this island not only as the country of their progenitors, but also as the residence of their gods. The syllable *tu* is perhaps that which is found in the Samoan *aitu*, spirit, and the *otúa*, *atúa*, *etúa*, which in the different Polynesian dialects, signify divinity. *Tuan* is the word for 'lord' in Malay, and *hautu* for 'spirit' in Malay, Javanese, and Bugis."

Art. II.—*On Three several Hurricanes of the American Seas and their relations to the Northers, so called, of the Gulf of Mexico and the Bay of Honduras, with Charts illustrating the same;* by W. C. Redfield.

(Continued from p. 169.)

Hurricane of the Honduras Sea, Cuba, and the Western Atlantic, in October, 1844.

This remarkable storm, which I designate as the *Cuba Hurricane*, came from the direction of the Pacific Ocean and the regions of Central America. It appears to have entered upon the bay or sea of Honduras, which is the western arm of the Caribbean sea, directly from the countries of Honduras, Poyais and Yucatan, on the 3d and 4th of October. From the Honduras sea it passed over the island of Cuba, the southern part of Florida, and the Bahama Islands, and continued in a northeasterly course, to the Gulf of St. Lawrence and the island of Newfoundland, with a rapidity of progress hitherto unknown in American storms. It swept, in its progress, the salient portions of the North American continent on the one hand, and the eastern parts of Cuba and Newfoundland, together with Bermuda, on the other; while its pathway exhibited an amount of injury and destruction such as is rarely known in the annals of commerce.

Precursory Storm. On the 1st and 2d days of October, Cuba was visited with stormy weather, attended by an extensive and unusual fall of the barometer; and this depression of the barometer was mainly or partially continued after the gale had ceased, the weather remaining unsettled. I cannot trace, otherwise than barometrically, the progress of this prelusive storm on its departure from Cuba, except at Key West, and again in the higher latitudes; as will be seen hereafter. It was included, evidently, in a vast gyrative influence which comprised both storms; while the principal or most active vortex was developed in the subsequent hurricane. It will be found that the barometric depression of this earlier storm, continued to advance along the whole Atlantic coast of the United States, and over a wide extent of adjacent country. The probable influence of this advanced diminution of pressure, on the course and progression of the hurricane which followed, may be hereafter considered.

Preliminary Statements. A violent thunder-storm, attended with heavy rains, visited Barbadoes and other windward islands, on or about the 25th of September; but, so far as I can learn, this atmospheric disturbance did not move down the Caribbean sea. On the contrary the weather was fine on the coast of Columbia, for the last ten days of September and the first week in October, with light westerly winds.[*]

A 'norther' of moderate force visited the eastern borders of Mexico during the latter days of September, of which I have found subsequent traces in the basin of the Mississippi. At Tampico and Vera Cruz two northers appeared between the 21st of September and the 1st of October, followed, at Vera Cruz and the southern part of the Gulf of Mexico, by a norther which was cotemporaneous and perhaps connected with the Cuba storm, prelusory to the great hurricane. An abridged extract from the logbook of the U. S. steamer *Union*, in the early part of October, from off Velasco to Pensacola, is given below, and her track will be found on chart IV, which illustrates this storm.[†] See also the abridged log of the R. M. steamer *Trent*.

Various accounts have been obtained from the tract of ocean lying east of the storm's path, by means of marine reports, vessels spoken, logbooks, &c.; and the positions of some vessels are marked on the chart. But we have no evidence of the prevalence of a storm in this region at that period, other than appears in our recitals.

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[*] Statements of shipmasters from that coast.

[†] U. S. steamer *Union*, Lieut. McBlair, at anchor off Velasco, Sept. 26th; P. M. fresh breeze from N. E. and squally; wind increasing with rain;—27th, increasing from southeastward till 8 A. M.; moderating till noon. Velasco W. by N. 6 miles. P. M. winds light and variable; from 4 P. M. fresh gales from northward and cloudy. Sept. 28th, A. M. fresh gales from northward with rain; P. M. fresh from northward and N. W. and cloudy, with a high sea. Sept. 29th, A. M. moderating and sea going down. Lat. obs. 28° 50′; P. M. at sea, moderate breeze from N. E. and pleasant. Sept. 30th, lat. 27° 48′, lon. (chr.) 94° 43′, moderate breeze E. N. E.; ends squally from N. E. Oct. 1st, moderate winds E. N. E. and pleasant; lat. 27° 53′, lon. 94° 15′, P. M. fresh breezes from N. E. by E., and E., pleasant. Oct. 2d, moderate and light winds E. N. E. and pleasant; lat. 28° 46′, lon. 94° 38′; P. M. same. Oct. 3d, light winds from N. E. and pleasant weather; lat. 28° 32′, lon. 94° 11′; P. M. light wind from N. and pleasant. Oct. 4th, moderate from N. E., clear and pleasant; 8 A. M. to noon fresh, N. N. E. and pleasant; lat. 27° 57′, lon. 92° 51′; P. M. moderate breeze from N. E. Oct. 5th, wind from N. E.; from 8 A. M. *a heavy swell from northeastward;* lat. 27° 22′, lon. 91° 30′; P. M. light winds from northward and pleasant. Oct. 6th, light winds N. W., N. and S. W. and pleasant; lat. 27° 50′, lon. 89° 40′; till 4 P. M. N. W. light and pleasant; evening, squally. Morning of 7th, N. W. pleasant; noon of 7th, lat. 28° 31′, lon. 87° 13′. [For a further account of the Northers on the coast of Mexico, near the close of September, see the report from R. M. steamer *Trent* in the recitals, case 2*c*.]

The accounts now to be exhibited will serve to determine the route, character, extent, and progression of this memorable hurricane, and of the barometric depression and the expanded storm which preceded it. The principal facts which these accounts afford, have been first duly noted geographically, upon a large marine chart; in process of which it became apparent that the chief violence of the gale was exhibited along the more central portions of the track. It was found, also, that a direct line drawn from the island of Ruatan, on the coast of Honduras, in the direction of N. 40° E., crossing Cuba, Sable Island and Newfoundland, would bisect the area of violence throughout this distance. It likewise appeared, on farther inspection, that by changing this line to one slightly curved, by bending its central portion slightly towards Cape Hatteras and its extremities in the opposite direction, it would be found to divide very nearly, that portion of the track in which the winds set in from the southeastern quarter and veered by the *south* to the westward, from that other portion of the storm's path in which its winds commenced from the eastern or northeastern quarter and veered by the *north* to the northwestern quarter. This line is therefore adopted on the annexed chart, (chart IV,) as indicating, with approximate accuracy, the route pursued by the axis of the gale, and will be called the *axis line.*

This axis line is supposed to intersect the 20th parallel of latitude near lon. 83°,—crosses Cuba to the eastward of Matanzas, passes near Orange Key,—near the west point of Abaco,—intersects parallel 30° near lon. 75° 15′,—par. 40° near lon. 65°,—par. 45° near lon. 58° 30′, and par. 50° near lon. 50° 40′. Lines are also drawn at the distance of sixty miles on each side of the axis line, as approximating a center path of one hundred and twenty miles in width; also at distances of two hundred and four hundred miles, on each side of the axis line, for the general purposes of reference, in scanning the observations. The supposed distances of the several vessels, or places of observation, from the axis of the gale, when nearest the same, will be stated in miles, sixty nine to a degree of the meridian,—with the initials, R. if to the right, and L. if to the left of the axis line.

Our limits do not allow the printing of the several logs and meteorological reports at full length and in their tabular forms;

but in the necessary abridgments of these, and of written statements received from shipmasters, I have endeavored faithfully to exhibit all that can serve to afford us any knowledge of the strength, extent and progress of the storm, and of the time and manner in which its winds were successively exhibited.

I will first submit such accounts of the storm as relate to the left hand side of the axis line, as far onward, in its course, as the south shore of Cuba, and including the adjacent portions of the Gulf of Mexico.

1. At Belize, British Honduras, lat. 17° 29′, lon. 88° 12′, [180 miles L. ?] the weather in the first week in October, as stated by the master of the *Gilbert Hatfield*, "was very bad;" with squalls and heavy rains; "very wild weather." The mate thinks the worst of the weather was between the 1st and 4th of October. [This position was in the Belize river, near the southeastern shore of the peninsula of Yucatan, and under the immediate shelter of the broadest if not the most elevated portion of Central America.][*]

Mr. Lonsworth, pilot at Belize, informed Capt. Good that the effects of the gale were experienced on all the Honduras coast. Capt. Reed was informed at Belize, that the gale was heavy outside, and that several vessels drove from the anchorage.

2*a*. Logbook of brig *Maria L. Hill*, at anchor off Campeche, lat. 19° 51′, lon. 90° 33′, [380 miles L. ?] "Oct. 2d, pleasant. Oct. 3d, strong Norther this day; received no cargo. Friday, 4th, strong Norther all this twenty-four hours; received no cargo. Oct. 5th, more moderate; wind still to the north."—From this time the weather continued pleasant till the 13th. [This appears to show us the left border of the gale.]

2*b*. At Grand Suline, (Bouche de Silan,) N. coast of Yucatan, lat. 21° 25′, lon. 88° 42′, [360 miles L.,] the *Betsey Hall*, loaded with mahogany and ready for sea, went on shore Oct. 4th, during a heavy swell and imbedded in the sand. The *Alexander Petron* and *Artebonite* also dragged their anchors and went on shore; the former knocked her bottom out and sunk.—(*Shipping Lists.*)

2*c*. Royal Mail steamer *Trent*, at anchor off Tampico, took a Norther on the night of Sept. 21st, and was compelled to slip cables and proceed to sea; continued blowing from N. N. W. till 24th, with barometer from 29·80 to 29·82. Returned to the anchorage and had strong breezes between S. E. and E. N. E. till 27th, when the wind hauled to N. N. E. At 4 A. M. of the 28th, a violent northerly gale set in, with no indication beyond the rising of the barometer, which compelled us to slip a second time, blowing from N. N. W., with a heavy sea, through the 29th, and continued with strong breezes on the 30th,—and fresh breezes Oct. 1st, with fine weather; the barometer ranging throughout the Norther, from 30 in. to 30·14; thermometer from 82° to 78° Fahr.

Oct. 2d, fresh breezes with dark blue clouds to the N. W.; at 8 A. M. anchored at Vera Cruz; bar. 30·15, wind increasing; noon, strong breezes, bar. 30·12; 4 P. M. fresh gales from N. N. W.; 6 P. M. proceeded to sea; 8 P. M. bar. 30·07, therm. 82°; midnight, heavy gales with much sea. Oct. 3d. A. M. fresh breezes from N. N. W., with thick rain and much sea; 8 A. M. bar. 30·02; noon, 30·00, lat. 20° 7′, lon. 94° 29′; 8 P. M. bar. 29·98, range of therm. 85° to 84°; towards midnight heavy gales from N. W. Oct. 4th, strong gales this day from N. to N. N. W. with heavy sea from northward, the bar. fell in half an hour from 29·98 to 29·90; 8 A. M. bar. 29·90; noon, bar. 29·92, lat. 20° 14′, lon. 92° 40′, *the swell became very high and came from N. E.*; [then 540 miles L. ?] weather hazy and sky of a copper-colored appearance, *small scud flying fast*; 8 P. M. bar. 29·92; therm. 84° to 83°. Oct. 5th, strong breezes and squally this day, from N. N. W. to N.; 8 A. M. bar. 30·02; noon, 30·02, lat. 21° 53′, lon. 90° 17′, [463 miles L. (?)] therm. 84° to 82°, atmosphere still hazy, air cooler to the sense, heavenly bodies much clearer. Oct. 6th, moderate breezes from N. by W. and fine, atmosphere clear and dry, bar. 30·02 to 30·05, lat. 22° 31′, lon. 87°, therm. 83° to 82°.—[Abridged from journal of J. F. Boxer, R. N., Commander, received from Col. Reid, February, 1846.]

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[*] The profile elevation of this part of Central America, above the two oceans, is believed to be about five thousand feet. But both eastward, and westward, near the Lake of Nicaragua, and at the isthmus of Tehuantepec, the elevation is inconsiderable, say five hundred feet.

[From the time of reaching Vera Cruz, this steamer appears to have experienced bad weather almost simultaneously with that which visited Jamaica and the S. side of Cuba, which remitted on the 3d; and on the 4th, this vessel evidently had begun to encounter the swell and blow pertaining to the Cuba hurricane, which abated on the 5th.]

3. Ship *Clyde*, laden with mahogany, left Omoa, [south part of the bay of Honduras, lat. 15° 45′, lon. 88°,] and has not been heard of; but part of her cargo was found, after the gale, near the Northern Triangles, lat. 18° 40′, lon. 87° 15′, [170 miles L.]

The brig *Florida Banca*, which, as we have seen, encountered the two previous hurricanes, left Belize Oct. 1st, and has never been heard from since that date.

4. Ship *Gossypium*, from Liverpool for New Orleans, on the 4th and 5th Oct., lat. 20° 30′, lon. 85°, [130 miles L.,] experienced a hurricane, with the wind veering round the compass; on 5th lost fore and main masts and sprung the rudder. Oct. 7th, spoke a brig from Jamaica which had lost spars and sails in the hurricane. [The phrase "round the compass," is used somewhat vaguely by seamen. This ship being in the left center of the gale, probably had the same succession of winds as the *Angola* and *Openango*. (Nos. 6 and 7.)]

5. Brig *Majestic*; Friday, Oct. 4th, commences with heavy weather blowing from E. S. E. At noon both masts went over the side, carrying with them bulwarks, &c. At 1 P. M. shipped a heavy sea, which washed away quarter bulwarks, with the captain and one seaman; at 3 P. M. a little moderate; at 4 P. M. increased in a hurricane from N. W. At 8 A. M. of the 5th, blowing a moderate gale from W. N. W.; made sail, on jury-masts, for Jamaica or Grand Cayman; lat. at noon by obs. 20° 15′, lon. 82° 45′. [Probable position on the 4th when the gale shifted, lat. 20° 30′, lon. 83° 10′, or 30 miles left of axis line; the brig having been afterwards driven with a N. W. gale, and being on or near the axis line at noon of the 5th.]

6. Brig *Angola* was dismasted in the hurricane, about 50 miles off the west part of the Isle of Pines, [(?) lat. 20° 45′, lon. 83° 40′, 69 miles L., ?] on the night of Oct. 4th. At 8 A. M. of the 4th, the gale had become so violent that the brig was hove to, and so continued till dismasted, the wind from E. N. E., veering to N. N. E.; was heaviest from 6 to 11 P. M., and continued to veer from N. N. E. to N. W., after which it began to moderate. The brig's barometer in the gale, was observed at 29 inches.

7. Brig *Openango*, from Jamaica; on the morning of Oct. 4th, it commenced blowing from the eastward and increased during the day, hauling to the northward. Had the heaviest of the hurricane from N. N. E. to N. N. W., between the hours of 5 and 10 P. M. of the 4th, lat. 21° 15′, lon. 83° 30′, [74 miles L.] It continued blowing during the night and veering to the N. W., gradually abating. Lost spars, sprung a leak, &c. When it moderated the brig was judged to be in lat. 20°, lon. 82° 30′.

8. Ship *Hermann*, for New Orleans, was dismasted in the hurricane, Oct. 4th, on the S. side of Cuba. On the 5th, saw a brig 150 miles from the land, totally dismasted, [(?) lat. 19° 50′, lon. 84°. ?]

9. Ship *Elizabeth*, encountered the storm on the night of Oct. 4th, the wind blowing a terrible gale from the westward.(?)* On the 5th, the gale increased to a hurricane, and shortly the main and mizen-masts were carried overboard by its violence. In the succeeding night it was found that the ship had sprung a leak; all took to the boats, and the ship soon went down. The boats then *pulled to the westward* in a heavy sea; one boat reached Sisal on the coast of Campeche, in six days; another was picked up by a brig bound to Vera Cruz; the third, containing the officers and most of the passengers, was never heard of. [This account seems to show that the ship was near the W. end of Cuba, in the Yucatan channel or the adjacent borders of the Gulf of Mexico.]

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* The true solution of this, probably is, that the wind was blowing from the westward at the time when the ship was dismasted; unless we assume the word "westward" to be an error. The report evidently is from the suffering seamen who survived.

10. Ship *Dantzig*, for Havana, was spoken on the 11th in lat. 23° 30′, lon. 86° 30′, having been dismasted in the hurricane *on the 4th October*. [Must have met the hurricane on the south side, or off the west end of Cuba.]

11. Barque *Franklin*, Oct. 4th, off the west end of Cuba, experienced a tremendous hurricane; [(?) 235 miles L. ?] lay to 17 hours under bare poles, part of the time on her beam ends, expecting the masts to be blown out of her; suffered much damage, *and was driven* 100 *miles to the S. W.* With calms and currents, took 14 days to gain her former position. [This shows clearly the general direction of the gale off the W. end of Cuba.]

12. Schr. *H. Plantagenet*, for Havana, encountered the hurricane in the Gulf of Mexico about forty miles from Tortugas, the wind blowing strong from N. N. E. [(?) 230 miles L.] Was compelled to throw over part of the cargo, but suffered no other damage.

We now pass from the left to the right side of the storm.

13. Brig *Trojan*, from Kingston, S. side of Jamaica, sailed Oct. 2d, and took the hurricane off the Grand Cayman, blowing from S. S. E. From the 1st of Oct. clouds had been flying thick and fast from the southward; the weather in the western quarter looking dark and threatening. Oct. 3d, the barometer had fallen, and it continued to fall till 8 P. M. of the 4th. Morning of the 4th, strong breezes from S. E.; at 9 A. M. had commenced blowing hard from S. S. E. During the day and evening the gale veered from S. S. E. to S. S. W., from which last point, about 9 P. M., was the worst of the gale. [Then about 145 miles R.] At 10 P. M. the barometer had sensibly risen, the wind settling at S. W. as the gale abated.

14. On a subsequent date, Capt. DAVIS, in the *Trojan*, spoke the brig *Homer*, which had sailed from Kingston *two days before him*, for Laguna, on the S. coast of the Gulf of Mexico, and had been totally dismasted on the 4th of Oct. [The *Homer* was probably in the heart of the gale.]

15. Brig *Eastern Star*, at Falmouth, Jamaica, [N. side,] Sept. 30th, fine weather; at half past 9 P. M. a heavy squall of rain. Oct. 1st, fine, with land breeze through the day; at 2 P. M. sailed for Black river, [S. side of Jamaica;] wind southward. At 7 P. M. was off Montego Bay; at 8 P. M. took in top gt. sails; fresh breezes from S. S. W. with squalls; at midnight, reefed. Oct. 2d, at 2 A. M. took in mailsail and jib; [first gale, which appears to have been more severe in Cuba;] at 8 A. M. shook out reefs; set the mainsail. At noon, the W. end of Jamaica bore S. S. W.; P. M. fine weather and head sea, wind S. E. by S.; fine breezes; at midnight, Cape Negril bore E. by S.

Oct. 3d, winds S. E. to S. S. E. with squalls and rain; at 4 P. M. blowing a heavy tempest; at 6 P. M. Cape Negril, S. point, bore E. S. E. [This cape is in lat. 18° 15′, lon. 78° 25′, 305 miles R.] At night, strong gales with heavy squalls. Oct. 4th, gale continues; at 9 A. M. bore up to make a harbor; at 11 A. M. ran into Orange Bay; [315 miles R.;] at noon, parted the best bower; P. M. and night strong gale and heavy squalls from S. S. E. with rain, thunder and lightning. Oct. 5th, at 4 A. M. parted the small bower and went to sea; bore up for the N. side, wind S. S. E. with squalls; at noon was off Falmouth. The wind veered during this day from S. S. E. to S. W.; fresh breezes and squally weather. Oct. 6th, calms and squalls.*

16. Capt. RAY, of brig *Com. Hull*, states that there was no blow at Falmouth, Ja.,; but on the night of the 4th and day following, a heavy sea hove in from the northwestward. [Lat. 18° 28′, lon. 77° 41′, 345 miles R., and under the shelter of the mountains or highlands of Jamaica, the wind being southward.]

17. At Montego Bay, Ja., [lat 18° 28′, lon. 77° 57′, 330 miles R., and under like shelter as Falmouth,] Oct. 4th, after threatening weather it commenced blowing hard from S. between 9 and 10 P. M. A strong ground swell had heaved into the bay from about 3 P. M., and before 2 A. M. of the 5th, it had acquired a terrific force. During the 5th there was

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* Perhaps the early appearance of the second storm or hurricane at Jamaica, indicates for it a more eastern origin than would be apparent from a mere inspection of Chart IV. There seems, however, to have been but little separation in the two storms in the latitude of Jamaica.

comparatively little wind, but the sea raged in the most dreadful manner.* This swell occasioned the loss of twenty one vessels in the bay, chiefly droggers and other small craft.

18. At St. Jago de Cuba the gale of Oct. passed over without any damage, as stated by Capt. Crowell, of the *Curlew*. [St. Jago is on the S. side of Cuba, lat. 20°, lon. 76° 7′, 365 miles R.; is N. E. from the center of Jamaica and more exposed than the latter to the storm from off the Caribbean Sea; but the harbor is sheltered.]

19. Ship *Norman*, for New Orleans, Oct. 1st, course W. by S., 4 to 7 knots, thick squally weather with showers of rain. No obs.; [lat. D. R. 18° 54′, lon. 75° 05′;] P. M. wind S. S. E. courses N. W. to W. S. W., 8 to 9 knots. Oct. 2d, strong gales from S. E. and thick cloudy weather; running down the island of Jamaica. No obs.; [lat. D. R. 18° 51′, lon. 77° 15′;] P. M. strong winds from S. and squally; at 6 P. M. S. end of Jamaica bore S. S. W. 30 miles. Through the night strong gales and thick blowing weather. Oct. 3d, at 3 A. M. double reefed the three topsails; [latter part of the precursory gale;] at 10 A. M. more moderate; set main-topsail and top gt. sail; no obs.; [lat. D. R. 18° 54′, lon. 80° 10′, 200 miles R.;] P. M. had strong gales from S. E. and S. S. E. and thick cloudy weather. Course W. by S. and W. S. W.; at 11 P. M. gale increasing.

Oct. 4th, at midnight double reefed topsails and furled mainsail, gale increasing; 2 A. M. wind S. S. E.; 4 A. M. took in jib and spanker; 6 A. M. close reefed the three topsails, furled fore-sail and mizen-topsail; at 7 A. M. gale increasing to a hurricane, furled the fore-topsail; at 9 A. M. hove the ship to with her head to westward, under close-reefed main-topsail and fore-topmast-staysail; wind S.; set balance-reefed spanker and mizen-staysail; hurricane increasing. Noon, lat. by bad obs. 19° 06′, [lon. D. R. 81° 40′, 140 miles R.] P. M. blowing a tremendous gale from S. which continued throughout the night with heavy gusts of rain; ship laboring heavy and masts in great danger. Oct. 5th, at 6 A. M. wind had veered to S. W., wore ship to S. E.; at 8 A. M. the gale abated a little; set close reefed fore-topsail. Lat. obs. at noon 19° 57′, [lon. D. R. 81° 28′.] P. M. blowing a heavy gale from W. S. W. and a heavy sea; set close-reefed mizen-topsail. At 11 P. M. wind W. Oct. 6th, at 4 A. M. set whole topsails and top gt. sails; at 6 A. M. saw the Grand Cayman bearing E. N. E. about 8 miles. [Drift and run since noon of 5th, 44 miles, courses S. by E., S. by W. and S. W.] At noon, light winds, in lat. 19° 15′, lon. D. R. 81° 42′.

The ship's barometer, when the gale hauled to S. W., was observed at 28·40. [Add 0·10 for its error of adjustment, as since compared with mine in New York, gives 28·50 inches. It is not certain that this was its lowest point. The nearest approximation of the ship's track to the axis *line* I estimate at 85 miles R.; which was *after* the axis of the gale had passed the ship. It will be perceived that the ship was constantly running or drifting towards the axis line, till after the axis and the heart of the gale had passed.]

20. Brig *Rebecca*, at St. Cruz, south side of Cuba, lat. 20° 44′, lon. 78°, [225 miles R.] Oct. 1st, had a heavy gale from S. W. with a heavy sea; in which a barque named the *Barker* was driven on shore. [First gale.]—Oct. 4th, it blew a hurricane from the southward, and the *Barker*, which had been got off, again went on shore. The sea now made a fair breach through the houses in the town, which is built on a single street, parallel to the shore. The heaviest part of the hurricane varied 3 or 4 points in direction, blowing in tremendous squalls, from S. S. E. to S. S. W.; and was attended with lightning and rain for 12 hours without intermission.—*(Mate of Rebecca and logbook.)*

21. Schr. *Arab*, was lost on Point San Juan, between Trinidad and Cienfuegos, on the morning of October 4th, and all but the mate perished. [Lat. 21° 44′, lon. 80° 32′, 65 miles R.] The schooner was prevented from getting into St. Jago by the violence of the [first] gale, and was carried to leeward and lost as above stated. [It appears from this case that the wind at Point Juan blew *on* shore, showing the right side of the gale.]

22. Brig *Levant*, from Kingston, Ja., for Campeche, was reported as having encountered the hurricane on the 2d of October, from E. and S. E., and at 5 P. M. was thrown on her beam ends, lost mainmast, and other damage. Next day spoke brig *Homer*, totally

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* Nautical Magazine, February, 1845.

dismasted. [As it is known from several sources that the Homer was dismasted on the 4th of October, there must be an error of two days in the date above reported. This account may serve, however, to show the direction of the wind in the first part of the gale and the probable position of the Homer, as being near the path pursued by the axis of the storm.]

23. At Trinidad, south side of Cuba, [lat. 21° 42′, lon. 80° 11′, 83 miles R.,] the hurricane was peculiarly severe, as also in its vicinity, blowing down houses in the town and destroying the plantations.

24. At Cienfuegos, [Xagua, lat. 22° 6′, lon. 80° 42′, 45 miles R.] the gale, though very severe, did less damage than at Trinidad. [Owing, probably, to the deeply sheltered position of the place.]

25. On the right border of the storm we find that the master of the Schr. *Ermina*, (at Nassau, N. P.) reports the loss of three vessels on the west coast of St. Domingo [Hayti] near Gonaives, in this gale. [Say in lat. 19° 38′, lon. 73°, 550 miles R. Vessels in this great bight or bay, were peculiarly exposed to being driven on shore by the S. W. winds under this border of the storm.]

26. At Turks Island, as reported by Capt. VARNEY, the gale blew hard from the southward; but not a hurricane. [Lat. 21° 22′, lon. 71° 8′, 565 miles R.]

We take now the accounts from Cuba and other reports, from the left side of the gale, as far onward as will include the peninsula of Florida and the Bahama Bank.

27. At Santiago de la Vegas, 50 miles westward of Havana, [lat. 22° 57′, lon. 83° 5′, 112 miles L. (?)] the hurricane began at 9 A. M. of Oct. 4th, and continued 14 hours.*

28. At San Christobal, on the southern slope of Cuba, about 60 miles S. W. by W. from Havana, [say 105 miles L.] Oct. 2d, it began to blow from the N. and every body supposed that the rains were going to cease. The wind continued to increase, and on the afternoon and night of the 3d it began to cause damage to the cornfields.

But it was reserved for the night of the 4th to consummate the destruction, and in every hour the wind seemed to increase. The gale continued till about 10 o'clock in the morning of the 5th, though the wind had begun slowly to subside.

29. At San Antonio de los Baños, [about 30 miles S. W. from Havana and 92 miles L.] Oct. 1st, a light dry wind from N. E., which by the morning of the 2d was quite strong; at noon it was more violent, changing during the evening and night to the East, and by the morning of the 3d had finished at South.

At midnight of the 3d there was rain, which increased and continued all the day and night of the 4th. About 5 P. M. of the 4th, the wind had begun to blow from the S. E. and it gradually increased till 10 P. M., when it had passed to the East. At 4 A. M. of the 5th, the wind was at E. N. E. and blew with inconceivable fury, and the rain fell in torrents. At 5 A. M. it blew from due North, and from that time till 10 A. M. or more properly 12, no human pen can paint its effects.

30. At Batabano, [south shore of Cuba, 32 miles S. by W. from Havana and 76 miles left of the axis line,] at 5 A. M. Oct. 1st, it began to blow from the N., and on the 2d at the same hour, hauling towards the N. W., it increased to a hurricane until the 3d, when it had subsided at the same time that some rain began to fall.

The 4th of October was rainy, and the wind blew from N. E. until 8 P. M., when the hurricane began; at 3 P. M. [?] of the 5th it became calm, the wind changing to N. W., whence it again blew strongly for two hours and then ceased.

31. At Guatao, five leagues from Havana, Oct. 2d, at 4 A. M., wind E. N. E., strong, in successive gusts and rain in transient squalls. At 7 A. M. wind stronger at E. N. E.; at noon, feeble from E. N. E.; at 6 P. M. wind hardly sensible, direction the same. Oct. 3d, all day a slight drizzling of rain with a light breeze.

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* The accounts from the island of Cuba are chiefly taken from the Diario de la Habana, as translated by Mr. John H. Redfield. The distances are estimated in a direct line.

Oct. 4th, wind N. E., hardly sensible; cloudy; noon, wind E. N. E., fresh, drizzling rain with intermissions; 8 P. M. wind N. E., strong and constant; continued rain; at 10 P. M. less rain and more wind. Oct. 5th, 1 A. M., no longer wind—it is a destructive hurricane; 4 A. M., some rain, wind N. N. E., frightful; 6 A. M., houses falling, roofs blowing off, &c. &c.; some rain; 9 A. M., wind N., more furious; noon, rain ceased; wind N. N. E., relaxing; at 6 P. M. the sun shone a quarter of an hour; wind N. W., light.

32. At Havana, [lat. 23° 9′, lon. 82° 19′, about 85 miles L.] as per Capt. Foster, ship *St. Mary*, Oct. 2d, it blew a gale from E. N. E., sufficiently strong to require the aid of the best bower anchor; atmosphere continued dry, but enveloped by a fine haze. Toward sunset the wind moderated, and during the night veered to E. S. E., with an overcast sky. This state of weather continued during the 3d, and in the evening there was much lightning in the S. E. quarter.

Early on the 4th, the wind was moderate from S. E., and cloudy, weather apparently unsettled. About 9 A. M. the wind veered gradually to E. S. E., E. N. E., and finally settled at N. E. by E., with squalls of wind and rain, and dense masses of clouds came swiftly from that quarter, but no lightning was seen. The squalls increased in violence with torrents of rain, continuing so through the night till early on the morning of the 5th, when it blew a terrific hurricane. As day dawned on the 5th, vessels in all directions were drifting their anchors, coming in collision, dismasting and sinking each other. The St. Mary [which we have seen was roughly handled in the two former hurricanes] was the only American vessel that rode out the gale without damage. At 10 A. M. the wind veered to North, and thence gradually to N. W. Even then the gusts were not exceeded in violence. By 5 P. M. the wind subsided to a moderate gale, with streaks of clear sky in the West. By 9 P. M. the wind became nearly calm, with a brilliant starry sky.

Sunday, Oct. 6th, ushered in most delightful weather. The extent of damage to the shipping was very great. Many were dismasted, numbers were sunk, and several had overset, remaining bottom up. The southwestern shores of the harbor were strewed with wrecks, and this in a port unrivalled for its secure anchorage.[*]

33. A barque and a brig arrived at Havana on the 6th, which had encountered the gale of the previous day *to the N. W. of the Tortugas*, where they experienced only an ordinary gale of wind, reducing them to reefed topsails. [(?) 260 miles L.]

34. At Matanzas, [lat. 23° 3′, lon. 81° 41′, about 50 miles L.] during September, the barometer exhibited few remarkable variations; but on the 1st of October it was 29·60 inches. In a few hours appeared a strong N. E. wind, which continued without change till the 4th, when the wind ceased and it began to rain abundantly.

But the barometer, *which generally stood at 30 inches*, notwithstanding the calm remained at 29 inches on the 4th, which gave reason to suspect that we should have heavy N. E. winds. In fact on the morning of October 5th it fell to 28 inches, thus indicating the terrible hurricane which almost immediately made its appearance. The wind, which at 10 P. M. of the 4th had begun to increase by degrees, at 2 A. M. on the 5th blew with such violence that no doubt could remain of the immense destruction which it threatened. When the day dawned it continued to blow from the N. E. with unheard of fury, and it was not till 10 or half past 10 A. M. that it began at all to abate. Shortly afterwards it veered continually and finally settled at West, whence it again began to blow with the same violence as in the morning. But at 2 P. M. the barometer began to rise, promising the cessation of the gale, which soon after took place. In fact, at three o'clock the storm had entirely yielded; and on the 6th at 9 A. M., the barometer stood at 29·80, and the weather was tranquil.

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[*] Capt. Boxer, of R. M. steamer *Trent*, says in his journal:—On arriving at Havana [Oct. 7th] we found the shores of the port strewed with wrecks—some bottom up, others with their masts out of water, and others washed partly on the wharves. From the consul's statement it appeared they had a heavy gale on the 2d of October, which lasted 24 hours. The weather then became hazy, (unusually so,) with light rain, rapidly driven. On the 4th, the sympiesometer and barometer gave indication of some awful change, particularly the former: and shortly after this warning, a furious hurricane set in from N. E., such as the oldest inhabitants have never before witnessed. Seventy two ships were either upset or driven on shore, and others dismasted. Houses were unroofed, windows blown in, and the crops seriously injured; damage computed at a million sterling. I tried to obtain the particulars of the fall of the barometer, but singular to say, no one could give me an exact account. All they stated was, they had never seen it lower.

35. At Cardenas, 26 miles eastward of Matanzas, [lat. 23° 2′, lon. 81° 15′, about 27 miles L.] at half past 11 of the 4th, after a heavy shower it began to blow a violent hurricane. The wind first prevailed at East, and went about to S. W. and N. with continual rain. The wind [hurricane] lasted for 24 hours.[*]

[I have no accounts from Port Cabayrien, Neuvitas, and other ports on the north coast of Cuba, in the right side of the gale, where the wind would be found blowing off the shore and therefore less violent in its effects. For the character of the precursory storm off the N. side of Cuba, near lon. 77°, see 45*b*.]

36. Schr. *Tasso*, off Havana, bound northward through the gulf of Florida. Capt. Hows says: The gale commenced with me Oct. 1st, in lat. 23° 30′, lon. 82° 40′, the Mariel Tables bearing nearly S., wind E. S. E. On the 5th at 2 A. M., it increased to a perfect hurricane; at 4 A. M. lost boat and sixty bales of cotton by the boarding of a sea, wind at this time E. N. E.; at 6 A. M. wind N. E.; at 8 A. M., N. N. E.; at 10 A. M., North, and the heaviest of the hurricane; at 2 P. M. of Saturday the 5th it had abated considerably, then blowing N. N. W. to N. W. and so continued till 4 P. M. when it changed to N. W., and at midnight I once more made the land, bore up for Havana, and arrived at 10 A. M. Sunday the 6th.

37. Ship *Columbo*, for New Orleans, took the gale at 11 P. M. of Oct. 4, near Cat Keys, (west edge of Bahama Bank,) which increased to a severe hurricane on the 5th from S. E., [shipping report of the time says E. S. E.] which suddenly abated at about 5 P. M. when off the Double Shots, between Salt Key Bank and Florida Reef, [? lat. 24° 15′, lon. 80° 30′, about 30 m. L. ?] and in twenty minutes came out from N. N. W. and N. W., and finally abated at 2 A. M. of Sunday, Oct. 6th. Lost sails, bulwarks, &c. [These winds, with the lull and shift to the opposite quarter, prove the ship to have been in the axis path and not far from its center.]

38. From the military post at Key West [lat. 24° 27′, lon. 81° 50′, about 118 miles L.] we have the following observations.

Date.	Barometer, (average.)	Wind.	Rain.	Thermometer at 3 P. M.	Wet bulb thermometer.
Oct. 1st.	30·10	E. N. E. to N. N. E.; a gale.		83°	80°
2d.	30·01	southeasterly; strong.	0·17 in.	78	76
3d.	29·94	N. E.; light.	1·96	78	76
4th	29·84	E. to N. E. increasing; strong.	1·75	75	75
5th	29·42	E. N. E. to W.; severe gale.	9·62	72	72
6th	30·00	N. W. strong; moderate.		79	73
7th	30·17	E. to N.; light.		84	77
8th	at 9 A. M. 30·26	N.; moderate.		84	79

The following hourly observations made during the hurricane are added by the medical officer, commencing at 1 A. M. Oct. 5th. These are highly valuable.[†]

Hours.	Barometer.	Winds and strength.	Hours.	Barometer.	Winds and strength.
1 A. M.	29·768	E. N. E. 7	12, noon.	29·217	N. E. by N. 9
2	·729	E. N. E. 7	1 P. M.	·166	N. E. by N. 9
3	·516	E. by N. 8	2	·134	N. by E. 9
4	·457	E. N. E. 8	3	·185	N. 9
5	·433	E. N. E. 8	4	·264	N. by W. 9
6	·402	E. N. E. 8	5	·410	N. N. W. 8
7	·335	N. E. by E. 7	6	·455	N. W. 8
8	·418	N. E. 7	7	·520	N. W. by W. 6
9	·536	N. E. 8	8	·551	W. N. W. 8
10	·331	N. E. by N. 9	9	·587	W. 7
11	·272	N. E. by N. 9	10	·642	W. 6

The gale was blowing in strength, from E. N. E., at 9 P. M. of the 4th. Sky wholly obscured from 1 A. M. to 5 P. M. of 5th. Rain from 1 A. M. 7·97 in. [Crisis of the gale about 2 P. M of the 5th, according to the barometer.]

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[*] The order of changes, here appears like a typographical error. Possibly it may have been written S. W. by the N.; or, S. W. and W.

[†] The scale of the wind's force adopted for the meteorological returns from the military posts, is from 0 to 10. No. 4 denotes a brisk wind and 9 a hurricane.

In an account printed at Key West, it is stated that the unequalled fury of the gale when at its height can scarce be conceived. It swept every thing before it—houses, fences, trees, vessels—and almost every thing in its course was levelled with the earth or borne off with frightful velocity.

39. At Indian Key, off the S. point of Florida, [lat. 24° 47′, lon. 80° 48′, about 75 miles L.,] most of the houses remaining there were blown down and all the wharves destroyed.

40. Brig *Ventrosa*, was lost on the Bimini Islands in the hurricane. [W. edge of the Bahama Bank, lat. 25° 40′, lon. 79° 12′, about 35 miles L.]

41. At Jupiter Inlet, St. Louis Sound and Indian river, on the E. shore of Florida, between lat. 26° 30′, and 28°, the gale was severe on the 5th. causing a great influx of the sea. [This part of the coast is 112 to 150 miles L. of the axis line.]

42. At Fort Brooke, head of Tampa Bay, Florida, [lat. 27° 57′, lon. 82° 35′, about 300 miles L.,] there was no rain, except light showers on the afternoon of Oct. 2d. The lowest observations of the barometer were made on the evening of the 5th and morning of the 6th, 29·79 in. It may have been lower in the night. The daily *averages* of the barometer and state of the winds, were as follows, viz —Oct. 1st, bar. 30·50, wind, E., 3; Oct. 2d, bar. 30·16, winds N. E. and E., 1 and 4; 3d, bar. 30·06, wind E., 1; 4th, bar. 29·94, wind N. E., 1; on the 5th, bar. 29·84, wind E., 2, 4, 6, 4;[*] 6th, bar. 29·88, winds N. E., 3, 2, 1; 7th, bar. 30·07, calm. [Fort Brooke is not more advanced in the track of the storm than the island of New Providence, Bahamas; and its deeply embayed position, on the west side of the Florida peninsula, doubtless contributed to its shelter from the force of the gale.]

43.[†] At Charlotte Harbor, [west coast of Florida, lat. 26° 48′, lon. 82° 5′, 228 miles L., and less advanced in the track than Fort Brooke,] the gale blew from N. E. and was much stronger than at Tampa Bay. Its violence greatly increased, on that coast, as we go S. toward Key West, as I am informed by Capt. Parker; this being in fact a nearer approximation to the center path of the gale.

44.[†] At Apalachicola, [lat. 29° 43′, lon 85° 05′, near 475 miles L. of axis line,] there was no gale; the winds were moderate from the N. E., with clouds flying somewhat briskly from that quarter.

45*a*. At St. Augustine, [Fort Marion, E. coast of Florida, lat. 29° 40′, lon. 81° 35′, 305 miles L.,] Oct. 1, bar. (average) 30·18, winds N., 4 to 8; 2d, bar. 30·18, wind E., 6; 3d, bar. 30·07, wind E., 3, 2; 4th, bar. 29·90, wind N. E, 1. On the 5th, bar. 29·99, 29·82, winds N. E., 3, N., 4, 7, N. E., 8, drizzling rain at 2 P. M.; violent wind at 10 P. M. equal to 9. [Heaviest of gale in the night.] 6th, bar. 29·75, 30·01, winds N. W. 5, 6, N. E. 3, 0; 7th, bar 30·13, wind W. 1, 0. The gale set in brisk A. M. on the 5th. [Distance from the axis line greater than at Tampa Bay, but the position of St. Augustine, on the E. coast, was far more exposed to the gale. The state of the barometer and winds show that both these places were toward the left border of the gale, which in passing onward did not fully extend its force to Savannah and Charleston.]

45*b*.[‡] Brig *Demarara*, at and from Neuvitas, N. side of Cuba, Sept. 28th, fair, light breeze from N. N. E.; 29th, fair, strong breeze from N. N. E.; 30th, begins calm, cloudy and hazy, 8 A. M. light breeze from N. N. W. Put to sea. Noon lat. 21° 46′, lon. 77° 08′; [Bahama Old Channel;] 1 P. M. wind S. W., thick and hazy, looking squally in the S. E.; 5 P. M. wind N. N. W., took in sail; 10 P. M. wind S., furled the courses, close-reefed fore-topsail, and double-reefed main-topsail. [Reefs on edge of Great Bahama Bank bearing northerly.] Oct. 1st, at 2 A. M. wore ship to westward and close-reefed the main-topsail; 4 A. M. wore ship; 8 A. M. kept off, and ran on to the edge of the Bank and then hove to, head to westward—continues blowing with a dangerous sea; noon, lat. 22° 22′, lon. 77°, wind S., a perfect gale, wore ship to the eastward; lying to under close-reefed topsails; 6 P. M. wore ship to westward; 8 P. M. wind S. E. by E. Oct. 2d, at 2 A. M. wore ship, head to E. N. E., a little more moderate; 3·30 A. M. wore ship to westward and then kept off and made sail; 7 A. M. wind E. S. E., shook out all reefs and set top gt. sails; [end of first gale;] 9·30 A. M. run off the Bank and then followed the edge down; 11 A. M. wind E. by S.; 11·30 A. M. made Ginger Key; noon, lat. 22° 43′, lon. 78° 11′; P. M. overcast, and fresh breeze from E. to E. N. E. Oct. 3d, 2 A. M. set stud. sails; 8 A. M. took in lower stud. sails; fresh breezes and flying clouds; noon, lat. 25° 05′, lon. 79° 32′; light breeze E. by N., weather thick and overcast; 4 P. M. wind E. N. E.; 8 P. M. E. by N.; ends light breezes and flying clouds.

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[*] Where successive entries for the same date are given for the military posts, they refer to the successive daily periods of observation, which are respectively, sunrise, 9 A. M, 3 P. M. and 9 P. M.

[†] 43 and 44 are given on the authority of Capt. Parker, who was then at Apalachicola, and afterwards acted as a commissioner at Key West, on vessels damaged in this gale.

[‡] This case with some others was not received in time for insertion on the map.

Oct. 4th, 4 A. M. wind E. S. E., rainy and squally; 7 A. M. wind S. E.; 10 A. M. wind light from S. S. E. and rainy; noon, lat. 27° 09′, lon. 79° 32′, thick rainy weather, wind E. N. E.; 3 P M. took in stud. sails, looking very squally; 6 P. M. heavy rain, ends thick and hazy. Oct. 5th, 1. A. M. wind E. N. E., strong; 6 A. M. in top gt. sails; 8 A. M. wind N. E. by E., single-reefed the topsails; rainy and squally; noon, lat. D. R. 28° 56′, lon. 79° 43′, squally, rainy and winds baffling; 2 P. M. wind N. E.; 5 P. M. a heavy squall from N. E.; at 6 P. M. hove to, under close-reefed topsails, head to eastward; blowing a heavy gale and a bad sea; 9 P. M. up E., off E. S. E. Oct. 6th, first part more clear, but a constant gale and very dangerous sea; 9 A. M. gale had veered to N. N. W.; noon, lat. obs. 29° 59′, lon. 79° 20′, clear weather and strong gale from N. N. W.; 1 P. M. set single-reefed topsail and fore-topmast staysail; 6 P. M. shook out all reefs and set jib; midnight calm and cloudy. [Distance from axis line at the height of the gale, 187 miles L.]

We will now look toward the axis of the storm near the Bahamas, and then follow the accounts which relate to the right side of its axis, as far onward as Bermuda on that side.

46. Brig *Rebecca*, [second of this name,] from Cienfuegos, on the 5th of Oct. encountered a tremendous gale from S. E., which shifted part of the cargo, but did no other damage. [This route and date, with the direction of the wind given, place this brig in the gulf of Florida, probably near the Salt Key Bank.]

47.* Brig *Saratoga* was crossing the Bahama Bank, Oct. 5th, when it began to blow, at 10 or 11 A M., from E. S. E. or S. E. by E. At noon saw Orange Key ahead; split close reefed fore-topsail and set reefed foresail, in attempting to weather it. Kept away and run to the N. of the Key; struck in passing off the Bank, about 2 P. M. and sprung a leak; gale increasing from S. E.; wore ship and stood back for the Bank, intending to run under Orange Key. The gale now hauled southward, and the brig having no after sails, fell off and drifted on the Riding Rocks, under fore-topmast staysail and reefed foresail, which were blown away when she struck, about 3 P. M., [lat. 25° 15′, lon. 79° 4′.] Thumped on the rocks till about half past 4 P. M., when she had worked over into deeper water. Both anchors were then dropped, which failed to hold her, when the stays were cut and the masts blew over; the wind now southerly; the sea was breaking over the vessel and sweeping off every thing movable. Kept the pumps going till about 7 P. M., when the brig sunk in about 4½ fathoms. At this time the narrator was entangled with the poop deck, which had separated from the vessel. He held on for a short time, was washed off, and floated on different articles, he thinks, for an hour; was then thrown again in contact with the poop deck, on which was a passenger, and to which, by a small rope providentially attached, he kept fast during the night.

Towards morning of the 6th, the gale began to abate, and about 4 A. M. the wind-spray had so far ceased that the stars were visible. At sunrise the wind was strong from the southwestern quarter and the two survivors were drifting eastward over the Bank. By 9 A. M. the gale so abated as to allow them to stand up. At noon it was nearly calm, and till about 10 P. M., when the wind came out from the eastward. This wind, during the night of the 6th, drove them off the Bank into the Gulf Stream, where they floated at the mercy of the waves, without food or drink, till Oct. 11th, when they were taken off, in a perishing state, by the barque *Zida*, in lat. 25° 40′, [(?) 28° 40′,] lon. 79° 45′. [Mr. S. was below at the commencement of the gale, and was called to reef the foresail at half past 11 A. M. I deem it proper to present the above details, but in estimating them, allowance may be made for the position and condition of this suffering observer. Orange Key and Riding Rocks are near the line given for the route of the storm's axis, but its actual course may have been a little devious from a direct line, and here more westward.]

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* From Mr. SIMONSON, 2d mate and survivor.

48. Ship *Chester*, passed Stirrup Key, [Berry Islands,] Oct. 11th, was boarded by the keeper of the light on Abaco, [Hole in the Wall, lat. 25° 51′, lon. 77° 09′, about 70 miles R.,] who reported that the hurricane had blown down all the houses. The wind was heaviest from S. E., on the morning of the 6th.

49. Schr. *Magnet*, Oct. 5th, 6th, near E. side of Abaco, [lat. 26°, lon. 77°, about 70 miles R.,] had a heavy gale of wind from E. S. E. to S. S. E., during which lost sails and spars, was thrown on beam ends, &c. [Latter part of gale not mentioned.] Saw Schr. *Chase* about one mile from Abaco, wind blowing on shore. Brig *Partridge* was also dismasted near Abaco.

50. Barque *Reform*, for Mobile, at noon Oct. 5th, fresh breezes from S. E. and cloudy; double reefed the topsails; at 2 P. M. made sail, and stood in W. S. W. for Abaco. At 5 P. M. made the land ahead and hauled the ship to the wind; at 6 P. M. tacked ship to the eastward, the wind increasing, with a heavy sea from S. E.; close reefed fore and main-topsails, furled courses, jib, and spanker; at 9 P. M. wind still increasing from S. E.; at 11 P. M. fore-topmast staysail blew out; took in fore-topsail and hove to under close reefed main-topsail, blowing heavy. Oct. 6th, at 1 A. M. the gale increased to a hurricane and blew away the furled sails from the gaskets. At 2 A. M. the gale suddenly subsided and the wind changed to S. W. [N. of Abaco, a few miles R.] In 30 minutes it was again blowing a hurricane from S. W., as hard or harder than before. About daylight it began to moderate, and at 11 A. M. the wind had veered to W. Lat. at noon 27° 31′.

51. Ship *Star Republic*, took the gale Oct. 5th, lat. 26° 46′, lon. 76° 58′, in company with *Reform*. Increased to a hurricane from E. S. E. till about 2h. 30m. A. M. of the 6th, when it died away, and in about 30 minutes shifted from E. S. E. to W. and came out from that quarter with great fury. At the time of the lull the barometer stood at 28·10, [or as corrected 0·14 for its adjustment, 28·24,] when it rose rapidly 3–10ths in 30 minutes, *and then remained stationary for two hours*; rising again as the gale abated. Lat. at noon of 6th, 27° 25′, lon. 77° 15′ by computation. [A few miles R. of our axis line.]

52. Brig *Josephine*, encountered the hurricane on the evening of Oct. 5th, 21 miles N. E. of the Hole in the Wall, [or S. E. point of Abaco,] blowing from S. E.; cleared the E. point of Abaco, and scudded before the gale till 3 A. M. of the 6th, when it lulled, and then came out from N. W., blowing a hurricane for four hours, which dismasted the brig. Lat. at noon 27° 30′, lon. 76° 30′. (?) [The brig's position at the time of the lull is supposed to be at the axis of the gale, which may have been to the right of our axis line.]

53. Nassau, N. P. [lat. 25° 04′, lon. 77° 18′, about 90 miles R.] We experienced a severe hurricane on the Banks on the night of Oct. 5th, and the loss of lives and property has been greater than that of any previous gale for some years. In this harbor, from the quarter we had the wind, S. E., all was protected, and no damage of consequence.—(*Bermuda Gazette.*)

A letter from an officer at Nassau, states that the gale commenced with the wind from S. E., and gradually drew round to S., ending about S. W.—(*Nautical Magazine.*)

54. Letters from Long Island, Bahamas, [lat. 23° 20′, lon. 75° 15′, about 275 miles R.,] state that the gale was by no means severe there, blowing only in squalls attended with torrents of rain. Rum Key has also suffered little from its fury.—*Ber. Gaz.* [Lat. 23° 41′, lon. 74° 43′, about 280 miles R.] These two islands are on the S. E. border of the Bahama group, and opposite the eastern part of Cuba, the highlands of which would afford some degree of protection, under the R. side of the storm.]

55. Ship *Berlin*, Oct. 5th–6th, lat. 26°, lon. 75°, [175 miles R.,] experienced a hurricane from S. E., veering S. W., with a heavy sea.

56. Barque *Lagrange*, Oct. 5th–6th, lat. 26° 30′, lon. 75° 30′, [127 miles R.,] experienced a very severe gale from S. S. E. to S.; which increased to a hurricane at 3 A. M. Lost bulwarks, deck load, &c.

57. Brig *Herald*, Oct. 6th, lat. 30°, lon. 73° 30′, [75 miles R.,] had a heavy gale from S. E.; hove to; cut away fore-topmast; gale still increased and hove the brig on her beam ends, and did not right again till the mainmast was cut away.

53. Ship *Sea Lion*, Oct. 6th, lat. 28°, lon. 70°, [330 miles R.,] experienced a heavy gale from S. E., which veered round to W. Lost foresail and fore and main-topsails.

59. Ship *Charlotte*, experienced the hurricane Oct. 6th, from S. E. to N. W., lat. 32°, lon. 73°, [about 15 miles R.] Lost every thing above the tops, with lower sails, yards, &c.

60. Ship *Russell Glover*, had the hurricane Oct. 6th, lat. 31° 32′, lon. 71° 45′, [95 miles R.] Lost spars, &c. &c.

61. Schr. *Victoria*, left New York Oct. 1st, with fine westerly winds, bound for Cuba. Oct. 5th, winds became eastward with thick weather and moderate, till 9 A. M. of 6th, when it commenced blowing in strong puffs from S. E., with thick mists or sprays, clouds flying very swiftly. The gale increased in violence and fury, and the vessel was reduced to balance-reefed mainsail and kept to the wind. At 11 A. M. it became so violent that the vessel was blown completely over upon her beam ends, her decks swept of every thing, and lay with no prospect of righting till the masts were cut away, when she came up, a helpless wreck. It was afterwards found that the wind was gradually shifting round to the southward, and from that to the westward. At 6 P. M. the gale had much abated, and at 10 P. M. had fine clear weather. Position at noon reckoned to be in lat. 32°, lon. 72° 30′, [38 miles R.] Had during the next day the heaviest cross sea Capt. BUNCE had ever witnessed.

62. U. S. brig *Pioneer*, Lieut. SHAW. Oct. 1st, 4 P. M. winds moderate from eastward, air 83°, water 84°, barometer 29·91. Midnight, wind S. E., air 80°, water 84°, barometer 29·83. Oct. 2d, A. M. moderate southeasterly breezes, rainy and cloudy; at noon air 63°, water 85°, barometer, 29·87; lat. obs. 25° 51′ 30″, lon. chr. 64° 38′ 30″; current S. half E. 20 miles. P. M. light southeasterly and variable winds; midnight air 80°, water 83°, barometer 29·78; ends squally with thunder, lightning, and rain,

Oct. 3d, A. M. winds moderate and variable, from N. E. to S. S. E., with frequent and heavy rains; ends pleasant; passed large quantities of sea-weed; noon, air 84°, water 82°, barometer 29 75; lat 26° 48′, lon. 65° 44′ 30″; current S. E. by S., 18 miles. P. M. moderate and variable breezes, between S. E. and S. W. and squally; ends cloudy with occasional heavy showers; air 79°, water 80°, barometer 29·70. Oct. 4th, A. M. moderate to fresh breeze from S. W.; 8–12, cloudy with passing squalls; air 82°, water 82°, barometer 29·70; lat. D. R. 28° 34′, lon. 67° 39′. P. M. moderate and variable southwesterly breezes, with squalls and showers, barometer at 4 P. M. 29·67. Midnight, air 79°, water 82°, barometer 29·75.

Oct. 5th, light breeze S. W. to N. W. and southwesterly, squally at 4 A. M., pleasant. Noon, air 83°, water 83°, barometer 29·80; lat. obs. 29°, lon. chr. 67° 53′. P. M. light and moderate breezes from S. W. to S. E. and S. S. E.; at 8 P. M. barometer 29·80; from 8 to midnight wind settling at S. S. E., with occasional squalls of wind and rain; barometer falling; air 81°, water 82°, barometer 29·78.

Oct. 6th, A. M. begins moderate, with passing squalls of rain, wind S.; 4 A. M. barometer 29·70, wind S. hazy; 8 A. M. barometer 29·65, fresh gales and hazy weather, with heavy squalls; at 10h. 30m. passed a schr. hove to; at 11h. 40m. gale still increasing. Noon, air 82°, water 78°, barometer 29·49; lat. obs. 30° 30′, lon. chr. 69° 52′. P. M. commences with fresh gales from S. and heavy squalls with thunder and rain; at 1h. 30m. was struck by a violent hurricane from S. S. W. while under close reefed foresail, single reefed fore-spencer, and fore-topmast staysail. The hurricane continued with nearly unabated violence during the watch, and barometer fell to 29·45, but rose again to 29·49 at 4 P. M. From 4 to 5 P. M. gale from S. W. and S. S. W. with a very heavy sea; from 5 to 6, wind moderated, but the sea the same; at 5h. 30m. hove to; from 6 to 8 P. M. moderate gale and very heavy sea; weather clear; lying to; 8 P. M. wind W. S. W. and from 8 to midnight high winds and passing clouds; sharp lightning all round the horizon; air 80°, water 82°, barometer 29·74. Oct. 7th, from midnight to 4 A. M. moderate breezes, varying between W. S. W. and W. by N, with a heavy swell and passing clouds. At 4 A. M. barometer 29·77; at 8 A. M. 29·82; noon, 29·87; winds W. by S. with a heavy swell. Noon, lat. obs.

31° 24′, lon. chr. 70° 06′. [Had run 40 miles to the northward since 3 P. M. of 6th, besides drift in lying to. Probable position at minimum of barometer, 213 miles R.]

63. Ship *Potomac*, Oct. 6th, at 4 A. M., reefed down the sails with the wind blowing at E.; at 6 A. M. took in foretopsail, gale S. S. E.; at 10 A. M. took in maintopsail, gale S. S. E.; 11 A. M. hurricane from S. S. E., lying under bare poles; at 11h. 30m. was hove on beam ends; cut away the mizenmast, then the mainmast, when she paid off and righted: Wind veering to all points of the compass. Lat. 32° 30′, lon. 71° 30′. [60 miles R.—I infer that the gale blew from the western quarter after these shiftings near the center, but the close of the gale is not mentioned.]

64. Ship *St. Cloud*, Oct. 4th, lat. 33° 01′, lon. 70° 40′, cloudy and light breeze from S. S. E.; night dark and squally, barometer low, and appearance of an approaching storm. Oct. 5th, A. M., wind S. S. E. to E. and calm; lat. 32° 13′, lon. 70° 55′; P. M., light breeze from W. and W. S. W., gradually veering to N. E.; barometer falling till midnight, when it blew a reefed topsail gale. Oct. 6th, gale still increasing, from E. N. E. to S. E.; barometer 28·70, and falling. At 6 A. M. the hurricane had commenced; furled all sail, ship's head to the southward; wind, apparently, nearly steady. At 9 A. M. barometer 28·40, and at a stand; at 11h. 30m. wind had veered to S. E.; noon, no abatement; lat. D. R. 32° 20′, lon. 70° 25′, (?) P. M. commences wind hauling more S., barometer steady at 28·35 to 28·40; 1 P. M. wind S. by E.; 2 P. M. S. S. W. and still blowing as hard as ever, and veering westward; about 3 P. M. the clouds began to break in the S. W., and the gale to abate; 4 P. M. wind S. W. by W., got ship's head to S. S. E. and set a little sail, wind moderating, and veered N. W. and N. N. W. in 12 hours; then in lat. 31° 53′, lon. 71° 40′. [The dead reckoning position on the 6th, seems not to accord with the observed positions on the 5th and 7th. Probable position at noon of 6th about 105 miles R.]

65. Brig *Brothers*, Oct. 6th, lat. 32°, lon. 70°, [150 miles R.,] was thrown on her beam ends and totally dismasted.

66. Barque *H. W. Tyler*, Oct. 6th, lat. 31° 30′, lon. 68°, [265 miles R.,] experienced a severe gale from the S. which blew away the reefed topsails and foresail, and did other damage.

67. The *Clara and Emma* was dismasted in this gale in lat. 32° 23′, lon. 68° 49′, [195 miles R.] and was abandoned in lat. 32°, lon. 76°.

68. Brig *Falcon*, encountered the gale Oct. 6th, in lat. 32° 50′, lon. 65° 40′, [315 miles R.] commencing from S. S. E. Was hove to from 4 P. M. till midnight. Two hours after its commencement, the gale began to veer gradually round to S. and S. W., and abated at W. It commenced blowing with a clear sky, but the clouds thickened up in the evening. A very heavy and irregular sea was running on the 7th.

69. At Bermuda, lat. 32° 15′, lon. 64° 40′, [380 miles R.] the following observations were made by JAMES IRWIN, signal director at Mt. Langton.

Date.	Hour.	Winds.	Force.	Weather.	Ther.	Barom.
Oct. 1,	9 A. M.	S. W.	4	c.	77	30·12
" 2,	9 A. M.	S. S. W.	5	c. m.	75·5	30·11
" 3,	9 A. M.	S.	3	c. m. p.	77	30·19
" 4,	6 A. M.	S. by W.	5	c. m. d.	70	30.07
" 4,	9 A. M.	S. W.	4	c.	76·5	30·04
" 6,	9 P. M.	S.	8	c. m.	76·5	29·85
" 7,	9 A. M.	S. W.	2	b.	76	29·94
" 7,	2 P. M.	N. W.	3	c.	78	30·02

An interruption occurs in these observations, Oct. 5th and 6th, but a daily series by an officer at the naval station, sent me by Col. REID, shows that the barometer at 10 A. M., of both 5th and 6th, was but little below the mean for October, and the wind is given, on the 6th, as S. S. E., 6; rain, 0·27 in. on the 5th, and 0·28 in. on the 7th or the night previous.

The roaring of a heavy sea on the reefs in the morning of the 7th, was generally noticed; and attentive observers at Bermuda promptly announced that a great gale had passed to the westward of the island, in the direction of Newfoundland.

Having followed the gale thus far, on the right side of its path, we may now return and trace its progress and character on the left side of its axis and along the American coast, from Florida towards the gulf of St. Lawrence.

70. Brig *Leonora*, bound southward, encountered the gale Oct 5th, between 5 and 6 P. M., preceded by a very heavy rain. During the night it blew heavy from E. S. E., with increasing force. At midnight hove to with head to southward, and so continued till the height of the gale, when, although under bare poles and an exceedingly stiff vessel, she was gradually blown over upon her beam ends by the force of the winds upon her spars and rigging, and lay buried in the sea, till, no hope appearing, the rigging was cut, when the masts instantly went over, and she righted with six feet water in the hold. The sails had been previously blown away, after being furled with strong additional lashings. About 9 A. M. of the 6th, the wind hauled suddenly to the northward, without any abatement, and continued blowing a severe hurricane, for about three hours longer, when it abated with the wind at N. W., and we judged ourselves then in lat 30° 40′, lon. 74° 45′. [Being a few miles L., and nearer the axis line than at the shift of the wind at 9 A. M. Capt. COLLINS had no chronometer, and the position may have been more westward than is here given.]

71. Ship *Arkansaw*, from New York for Mobile, had the storm commence gradually on the night of Oct. 5th, and at 3 A. M. on the 6th was blowing a full gale from E. S. E., which at 8 A. M. had increased to a terrific hurricane, from the same quarter. At half past 9 A. M. the wind suddenly abated, hauling at the same time by the N., and in fifteen minutes from the first lull, had set in again in full fury from W. N. W., which soon dismasted the ship. Capt. BUNKER, in 32 years service, had never seen any thing like it in violence and strength. After blowing from this quarter for near two hours, the hurricane began to relax in force till reduced to a common gale of wind. At midnight the gale subsided. Position at the shift of the gale about lat. 31° 30′, lon. 75°. [55 miles L.]

72. Brig *Sterling*, for New York, Oct. 5th, at noon in the Gulf Stream, lat. 32° 31′, lon. 78°, [233 miles L.,] fresh breezes from N. E. and cloudy, heading E. S. E., all sail set; 3 P. M. took in light sails; 5 P. M. single reefed topsails and trysail; 6 P. M. tacked again to E. S. E. and at 8 to N. N. W.; took in mainsail and jib and tacked to E. by S., the gale increasing and hauling northerly; at midnight close reefed topsail and trysail and furled the foresail. Oct. 6th, at 4 A. M., wind N.; at 8 A. M. took in foretopsail. At noon heavy gales from N. N. W. and squally, with a high sea; lat. 33° 04′, near the outer edge of the Gulf Stream, [about 150 miles L.,] at 2 P. M., wind N. W., strong gales and rainy, lying to under close reefed main-topsail. At 5 P. M. began to make sail; at midnight light airs and cloudy.

73. Savannah barracks, Geo., lat. 32° 05′, lon. 81° 07′, [370 miles L. of axis line.] Oct. 5th, winds N. to E., 1; 6th, W. (?), 1 to 3; 7th, W. 1 to 2. No rain nor gale reported.

74. Augusta arsenal, [470 miles L. and 100 miles N. W. of Savannah,] daily average of barometer: Oct. 1st, 29·843; Oct. 2d, 29·823; 3d, 29·736; 4th, 29·564; 5th, 29·546; 6th, 29·488; 7th, 29·592. Winds from 2d to 5th light, chiefly S. W.; 6th A. M. N. E. 3; P. M. N. W. 1.

75. Charleston, (Ft. Moultrie,) lat. 32° 46′, lon. 79° 46′, [335 miles L.] Oct. 1st, barometer, (av.) 30·375; 2d, 30·310; 3d, 30·054; 4th, 29·875; 5th, 29·975; 6th, 29·803; 7th, 30·10. Winds, 5th, N. 3, 4, E. 4, N. N. E. 4; 6th, sunrise, N. N. E. 4; during day, N. W. 4; 9 P. M. W. 3; 7th, variable, 2. [The last three places appear to have been little exposed to the gale, as a surface wind, but were all quite within its barometrical influence.]

76. Fort Johnson, near Cape Fear, N. C., lat. 33° 54′, lon. 78° 01′, [300 miles L.] Oct. 6th, A. M., wind E. 6, N. E. 6; P. M., N. E. 5; 9 P. M., W. 2. No rain noticed.

77. Fort Macon, near Beaufort, N. C. lat. 34° 41′, lon. 76° 30′, [270 miles L.] Oct. 6th, A. M., wind N. 3; P. M., N. 6. No rain. [At the last two posts we have the gale blowing in considerable strength, without rain.]

78. Brig *Capt. John*, had the gale in lat. 34° 22′, lon. 76° 20′, [near Cape Lookout, 240 miles L. of axis line.] Shipped a heavy sea, which stove the galley and killed the cook.

79. Barque *Bashaw*, Oct. 6th, lat. 33° 10′, lon. 75° 15′, [140 miles L.] experienced a gale from N. E. which blew away main-topsail yard, top-gallant mast, &c.

80. Brig *Pennsylvania*, Oct. 6th, lat. 32° 40′, lon. 74°, [57 miles L.] was thrown on her beam ends in the hurricane, and totally dismasted.

81. Brig *Emeline*, Oct. 6th, lat. 33° 30′, on the southern edge of the Gulf Stream, [(?) lon. 74° 30′, 117 miles L. (?)] had the gale come on gradually, with a fine small rain, from N. E. to N. N. E., ending N. and N. N. W.; barometer fell to 28 in. [28·15 in. as corrected for index error;] lay at the mercy of the waves with all hands lashed to the weather rail; gale lasted from 4 A. M. to 4 P. M., and continued fresh till 8 or 10 P. M. The gale began to shift northward about noon.

82. Brig *Republic*, Oct 6th, at 6 A. M. was 85 miles east from Cape Hatteras, lon. 74°, [148 miles L.,] where the gale commenced blowing in the morning from E. N. E., gradually increasing and veering to the northward; vessel scudding at the rate of ten knots. At noon the gale was nearly N., blowing exceedingly heavy. Continued to scud through the gale, and the Captain believes the brig could not have stood an hour if brought to the wind. At 3 P. M. run out of the southern edge of the Gulf Stream. The gale ended about 6 P. M. in tremendous squalls from N. W.

83. The Captain and crew of schooner *Evelina* were taken off the wreck, Oct. 7th, in lat. 34° 50′, lon. 74° 30′, having been dismasted the previous day, [about 160 miles L.]

84. Schooner *Rochambeau*, Oct. 6th, lat. 33° 58′, lon. 73° 15′, [72 miles L.] experienced a severe gale, lost head of foremast and received other damage.

85. Brig *Wm. Nelson*, from Hayti, lat. 35°, lon. 74°, encountered a severe gale from N. E. to N. W., which lasted 24 hours, [162 miles L., and subject to the drift of the Gulf Stream.]

86. Schr. *Tioga*, Oct. 6th, A. M. begins with a light breeze from N. E.; at daylight wind increasing, took in topgallant sails and flying jib; 8 A M. double reefed foresail and mainsail, and took bonnet off the jib; thick rainy weather and heavy gale; hove to under two reefed foresail, head to southward, about lat. 35° 10′, lon. 75°, on the inner edge of Gulf Stream, 200 miles L.] P. M. gale increasing from N. E., set storm staysail; from 4 to 5 P. M. gale exceeding heavy and veering northward; 8 P. M. wind N. less severe; midnight, gale had veered to N. W. and continued to moderate; at 7 A. M. of the 7th, made sail on the wind.

87. Ship *Cotton Plant*, was dismasted Oct. 6th, near lat. 35°, lon. 74°, [about 162 miles L.] in a gale from N. E. and N. N. E., which for a time blew a hurricane, and veered to N. N. W. Hurricane abated at 5 P. M., but gale continued violent during the night.

88. Ship *B. F. Lamar*, Oct. 6th, wind N. E., cloudy; 6 A. M. wind increases with rain; noon, lat. 35° 30′, on inner edge of Gulf Stream, [about 200 miles L.,] wind strong from N. E.; P. M. heavy gale from N. E. by N., inclining northerly, with heavy rain; 4 P. M. blew a tremendous hurricane; 6 P. M. the clouds were clearing away; midnight more moderate. set foresail; morning of 7th pleasant.

89. Brig *Clara*, Oct. 6th, experienced a hurricane from N. N. E. to N.; at 5 A. M. broached to, was hove on her beam ends and dismasted; lat. 34° 30′, lon. 73° 30′, [about 120 miles L. Only the *hurricane* part of the gale appears to be reported.]

90. Schr. *Magnet*, [second of this name,] was totally dismasted Oct. 6th, lat. 33° 45′, lon. 72° 30′; Captain and crew taken off the wreck. [About 35 miles L. of axis line.]

91. Ship *Rienzi*, from Rio Janeiro, experienced a tremendous gale, Oct. 6th, from N. E. and E., [(?) E. and N. E. ?] veering by N. to N. W.; lat. 34° 30′, lon. 73° 15′, [100 miles L.]

92. Brig *Growler*, Oct. 6th, lat. 35°, lon. 73° 30′, (?) [138 miles L. ?] encountered a severe gale from E. N. E., and while scudding under close reefed topsail, the gale abated to a dead calm, and on a sudden shifted to N. W., which hove the brig on her beam ends. [A comparison of this report of the winds with the numerous accounts from this part of the ocean, shows an apparent error in the Growler's position, as above given. Doubtless it must have been much nearer the axis line. Such errors of figures occasionally occur in marine reports; and these should therefore be verified, when practicable.]

93. Barque *Hebe*, Oct. 6th, lat. 35°, lon. 73°, [105 miles L.,] experienced a severe gale from N. E.; shifted the cargo, lost spars, &c.

94. Ship *Europe*, lost sails, &c., Oct. 6th, in a hurricane from E. S. E., [E. N. E. ?] in lat. 35° 25′, lon. 73°. [118 miles L. There seems to be an error here, either in direction of wind or locality, when compared with the other observations.]

95. Barque *Montpelier*, Oct. 5th, wind W., 8 P. M. wind N.; Oct. 6th, wind N., light breezes; 4 A. M. wind increasing from N. E.; at 7 A. M. took in jib and mainsail—wind not stated; 9 A. M. double reefed the topsails; noon, wind E., took in foresail and close reefed the topsails, heavy gale and rough sea; 4 P. M. took in fore-topsail and hove to with head to southward; 5 P. M. took in main-topsail; 6 P. M. wind N. N. E.; 7 P. M. cut away the topmasts, vessel lying rail under and would not right; 10 P. M. wind N. N. W.; 11 P. M. gale abating. Oct. 7th, moderate breeze from N. N. W. and a heavy sea; noon, lat. 35° 50′, lon. 72° 15′, [about 108 miles L.]

96. Brig *John R. Gardner*, left New York Oct. 4th, with westerly winds, which on night of 5th hauled to N. N. E. and increased, the vessel scudding before it, till it became one of the most terrible hurricanes that ever swept over the Gulf Stream. [Direction at height of gale not given.] We were now, Oct. 6th, in about lat. 35° 25′, lon. 73° 30′, [about 140 miles L.,] when the vessel broached to and lay on her beam ends; cut away mainmast, with which went the head of foremast, when she righted. Completed the voyage to Honduras under jury masts.

Capt. Good, who was then mate of the *J. R. G.*, informs me that the gale commenced at N. E., and that in its last stages it veered to N. and N. N. W.

97. Fort Monroe, near Norfolk, Va., lat. 37°, lon. 77° 40′, [345 miles L.] average of barometer, Oct. 1st, 30·57; 2d, 30·465; 3d. 30·129; 4th, 29·844; 5th, 30·052. On the 6th, A. M. 30·014, P. M. 29·842; 7th, 30·187. Winds, 1st to 5th moderate; 6th, A. M. E. N. E. and N. E. 3, P. M. N. E. 6, 9 P. M. N. W. 2. No rain reported in the seven days. [These observations indicate the presence of the gale in some strength on the 6th, and the barometric depression on the 4th appears connected with the advance of the first Cuba storm.]

98. Fort Severn, Annapolis, Md., Oct. 6th, winds N. E., 2 to 4, [440 miles L.]

99. Fort McHenry, Baltimore, Md., [465 miles L.] Oct 6th, winds N. 1; N. E. 3; N. E. 4; E. 1.

100. Schr. *Orozimbo*, left Delaware bay for Boston on the evening of Oct. 5th, wind W. N. W.; 9 P. M. Cape Henlopen bore W.; before midnight wind hauled to N. N. E. Oct. 6th, at daylight wind N. E., cloudy, breeze increasing; 11 A. M. near Five Fathom Bank, reefed topsails and mainsail; noon, 25 or 30 miles E. by S., or E. S. E., of Cape May, wind N. E., increasing; 3 P. M. took in topsail; 5 P. M. blowing heavy gale from N. E., took bonnet off jib, three reefed and handed the mainsail, and hove to under foresail; 11 P. M. lost boat from the davits; from midnight gale moderating and veering northward. Oct. 7th, at daylight wind N. N. W., more moderate, set three reefed mainsail and head of jib; noon, strong breezes N. N. W. and cloudy. [About 320 miles L.]

101. At Lewes, Del. [south shore Delaware bay, 360 miles L.] there was "a strong N. E. gale."

102. Fort Mifflin, Delaware river, lat. 39° 51′, lon. 75° 12′, [408 miles L.] There was no rain nor gale, but a strong breeze on the night of 6th from N. E. Oct. 6th, sunrise, wind N. E. 1; 9 A. M. N. 1; 3 P. M. N. 3; 9 P. M. N. E. 4. Oct. 7th, sunrise, N. 1; day, N. W. 1.

103. Ship *Orleans*, near to the coast of New Jersey, between Egg Harbor and Sandy Hook, [about 350 miles L.,] had the hardest of the gale on the night of Oct. 6th, from N. E. to N. W.; was reduced to three reefed topsails for three hours, in carrying sail upon the wind.

104. Barque *Washington*, sailed from Thomaston, Me. for St. Kitts, Oct. 3d. On the 6th, in lat. 37° 55′, lon. 70° 43′, encountered a severe gale from N. E. to E. S. E.; lost topsails and deck load, stove bulwarks, &c. [128 miles L. In this case, as in 91, the report of the hurricane-wind seems to have been taken down by the news collectors without regard to the order of time. On collating the surrounding observations, it appears certain that the E. S. E. wind preceded that from E. N. E. As frequently happens, the direction of the later part of the gale is not mentioned.]

105. Schr. *St. Pierre*, encountered the gale Oct. 6th, in lat. 37°, lon. 69° 36′, [56 miles L.,] which commenced from E. S. E. at 4 P. M., and lasted 14 hours, during which it changed to N. W.

106. At New York, lat. 40° 42′ 40″, lon. 74° 01′, 400 miles L. of axis line; Oct. 1st, 10 A. M. barometer 30·53; during the day winds light, chiefly from S.; cirrous clouds from W.

N. W., cloudiness 0 to 5. Oct 2d, 10 A. M. barometer 30·49; winds E. N. E. to S. 2; cloudiness 10 to 4; upper clouds (cirri) from W. S. W. and W., lower do. (cum.) from S. Oct. 3d, 10 A. M. barometer 30·17, 10 P. M. 29·94; winds chiefly S. S. E. 2 and 3; upper clouds (cir. strat.) from S. W., lower do. (cum.) from S. S. E., cloudiness 4 to 9; slight rain in the night. Oct. 4th, 7 A. M., barometer 29·75, 6 P. M. 29·66, 10 P. M. 29·69; winds N. N. E., W. S. W. and W., 2 and 3; cloudiness, A. M., 10 to 4, being cum. strat. from S. W; P. M. cloudiness 10 to 0, upper clouds from S. W., lower from W. by S. Oct. 5th, barometer 29·78, to 29·99; winds W. to N. W., 4–3; cloudiness 0 to 1, being scattered cumuli from N. W.

Oct. 6th, 7 A. M., barometer 30·05, winds N. N. W. 2, clouds (cum. strat.) from S. W. cloudiness 9 with a clear horizon at N. W.; 10 A. M. barometer 30·06; winds (to 2 P. M.) N. by W. to N. E., 2; clouds, cum. strat. from S. W., cloudiness 8, still clear at N. W.; 2 P. M. barometer 29·96; wind N. N. E., 3; upper clouds from S. W., as before, with a lower stratum of cumulus or storm scud flying from N. E. with increasing speed, cloudiness 9½ or 10, with a bright streak or band still at N. W.; 6 P. M. barometer 29·90; wind and clouds much as before; 10 P. M. barometer 29·84; winds and clouds without visible alteration. The observer's position is on the west side of the city, and it is probable that the force of wind on the *east* side, at 6 and 10 P. M. was 4 to 6. Strength of wind in the night greater, but not known. Oct. 7th, 7 A. M. barometer 30·02, wind N. by W. 3; upper clouds (stratus) from S. W., lower clouds (cum.) from N. by W., cloudiness 9½, with open horizon at W. N. W.; 10 A. M. barometer 30·05, winds N. N. W., 4; upper clouds from S. W., lower clouds from N. N. W., cloudiness 6 and clearness in the N. W. greatly enlarged; 2 P. M. barometer 30·06; winds N. W. 3, with cum. clouds flying from W. N. W., cloudiness P. M. 9 to 6; 10 P. M. barometer 30·18; winds N. W. 3; cum. clouds from W. N. W., cloudiness 2.*

The value of observations near the border of the *gale*, and through its whole barometrical period, may justify this last recital. No rain was noticed at New York, on the night of the 6th, but at Jamaica, L. I., eleven miles east, the rain-gauge showed 0·06 in., which probably marks the boundary of rain on this side of the gale. At Goshen, N. Y., and other places in the great valley of the Blue Ridge, which ranges about forty miles N. W. of New York city, the weather continued "fair" during both the 6th and 7th of October, winds chiefly northeasterly.

107. At North Salem, N.Y., lat. 41° 20′, [389 miles L.,] Oct. 6th, winds N. rainy in night.

108. At West Point, on the Hudson, lat. 41° 23½′, lon. 74°, [427 miles L.,] Oct. 6th, A. M. winds N. W., 1; P. M. N., 2; 10 P. M. N, 3. No rain. Oct. 7th, winds N. A. M.; N. W. P. M.

109. At New Haven, Ct., lat. 41° 18′, lon. 72° 57′, [330 miles L.,] Oct. 2d. A. M. bar. 30·40, winds N. W. and N. E., 1; P. M bar. 30·30, winds S. E., 1, 2. Oct. 3d, half past 6 A. M. bar. 30·10; 9 P. M. 29·89; winds A. M. S. E., 2, 4; P. M. E. S. E., 4, rainy. Oct. 4th, A. M. bar. 29·70, 29·63, winds E. S. E., 6, S. W. by W., 3, rainy; P. M. bar. 29·58, 29·56, winds N. W. to S. W., 1. Oct. 5th, bar. 29·60, 29·86, winds W. and W. by N. Oct. 6th, A. M. bar. 29·92, winds N., 3; P. M. winds N. by E., 2; 9 P. M. bar. 29·72, wind N. E., 4; some rain in night. Oct. 7th, half past 6 A. M. drizzling rain, bar. 29·80, wind N. by W.; P. M. N. W.; 9 P. M. N. W., bar. 30·02.

110. At Fort Trumbull, Ct., lat. 41° 20′, lon. 72° 08′, [359 miles L.,] Oct. 6th, A. M. wind W., 1, N. W., 2; P. M. N. E., 3; 10 P. M. N. E., 5. Oct. 7th, A. M. N., 2, 3; P. M. W. 3. Rain, from 9h. 30m. P. M. of 6th to 10 A. M. of 7th, 0·57 in.

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* The facts in this report are from my own journal. The scale of *cloudiness* is from 0 to 10, the latter indicating the total obscuration of the horizon. Scale of winds, 0 to 12.

111. Ship *Hottinguer*, for New York, Oct. 6th, noon, lat. 40°, lon. 70°. Had the gale from N. E., veering by N.; carried light sails till dark, in lon. 71½°, running 10 knots. At 8 P. M. close-reefed topsails, furled mainsail, jib, spanker, and mizen-topsail, and run before the gale. Oct. 7th, at 8 A. M. moderate, out reefs and made sail; lat. at noon 39° 17′, lon. 73°. [At height of gale, about 265 miles L.]

112. Ship *Isabella*, Oct. 6th, it commenced blowing hard from N. E. at 6 P. M., and blew very hard for five hours, from N. E. to N. N. W., ending at N. W. Lat. 40° 30′, lon. 72°. [306 miles L.]

113. Ship *Columbiana*, experienced the gale on the night of the 6th, lat. 39° 40′, lon. 70°. [185 miles L.] Lost fore-topmast, and otherwise disabled; had all sails furled at the time.

114. At Fort Adams, R. I., lat. 41° 28′, lon. 71° 23′, [324 miles L. of axis line,] Oct. 1st, av. of bar. 30·401; Oct. 2d, 30·439; Oct. 3d, 30·143, A. M. wind S. E. and S., 3; P. M. S. E., 3, 4, rain from half past 1 P. M. Oct. 4th, bar. 29·784 to 29·595, wind S., 3, E., 4, heavy rain till noon, (2·1 inches,) clearing up with a sudden change from S. E. to W.; P. M. wind S. W. and N. W., 3. [This shows distinctly the first Cuba gale.] Oct. 5th, bar. 29·682 to 29·843, winds W., 4, 5; 10 P. M. W. 3. Oct. 6th, bar. A. M. 29·921, 29·984; P. M. 29·945, 29·972, winds A. M. N. W., 3, 2; P. M. S. E., 1, N. E., 5; heavy rain with high wind in the night; (rain 1 in.) Oct. 7th, bar. 29·776 to 30 in.; wind A. M. N., 5, 4; P. M. N. W., 3, 2.

115.[*] At Amherst College, Mass., [lat. 42° 22′, lon. 72° 28′, about 412 miles L.] Oct. 2d, bar. 30·15, 30·03, winds S. and S. W., 1, 2. Oct. 3d, bar. 29·91, 29·78, winds S. E., 1, 3, very rainy night. Oct. 4th, bar. 29·52, 29·30, winds E., 1, S., 2, S. W., 1, rainy morning. Oct. 5th, bar. 29·31, 29·51, winds S. E., 1, N. W., 3, 2, blustering. Oct. 6th, bar. 29·70, winds S. E., 1, N. by W., 2; clouds, stratus from S. W.; P. M. from N. E.; [probably lower scud clouds;] fair—lowering and chilly. Oct. 7th, bar. 29·60, 29·78; a little sprinkle in morning; cloudy and chilly day; winds, sun r., N. by W., N. W.; fair at 6 P. M.; 8th, bar. 29·90, winds N. W. and W., 1; fair, fine.

116. State Lunatic Hospital, Worcester, Mass, elevation 483 feet, lat. 42° 16′, [lon. 71° 47′, 376 miles L.] Oct. 2d, bar. *sunrise* 29·83, *sunset* 29·74, winds S. W., fair. Oct. 3d, bar. 29·59, 29·45; winds S. W., S. E., fair, cloudy, rain from 3 P. M., 0·83 in. Oct. 4th, bar. 29·18, 28·93, winds S. E., N. W., S. W.; rain 1·66 in., fair, cloudy. Oct. 5th, bar. 28·95, 29·13, winds S. W., N. W., fair, cloudy. Oct. 6th, bar. 29·35, 29·30, winds W. and N. W., fair, cloudy. Oct. 7th, bar. 29·19, 29·40, winds N. W.; raining at sunrise, (0·21 in.,) cloudy.

117. In the Vineyard Sound, S. coast of Mass., lat. 41° 27′, lon. noon, 70° 45′, [300 miles L.,] the Schrs. *Henry* and *Cambridge* were dismasted at their anchors, in the gale from N. E., on the night of Oct. 6th.

118.[†] At Nantucket, lat. 41° 15′, lon. 70° 06′, [260 miles L.,] Oct. 4th, bar. 29·55, 29·50; winds S. E., 2, S. W., 1, cloudy and showers, fair. Oct. 5th, bar. 29·56, 29·58; winds W. S. W. 3, 2, clear. Oct. 6th, 9 A. M. bar. 29·85, wind N., 1, fair, slightly overcast with cirri; 3 P. M. bar. 29·85, E., 1, cloudy, grows thick and looks threatening, wind increasing; 6 P. M. bar. 29·80, N. E., 2, cloudy, every indication of a storm; 8 P. M. bar. 29·66, N. E., 3, rain, wind increasing; 10 P. M. bar. 29·60, N. E., 4, rain, gale increasing; 12 P. M. bar. 29·50, wind 6, and rain, gale extremely heavy. Oct. 7th, 9 A. M. bar. 29·70, wind N. N. W., 4½, slight rain; (whole rain 1·50 in.;) 3 P. M. bar. 29·80, N. N. W., 2, clearing. Oct. 8th, 9 A. M. bar. 30·04, wind N. N. W., and N. W., 1, weather delightful.

119. Schr. *Mogul*, Oct. 6th, 7th, lat. 40° 35′, lon. 69° 09′, [195 miles L.,] took a heavy gale from eastward, which blew a hurricane for about 4 hours; split balance reefed mainsail, was hove on beam ends and dismasted.

120*a*. Ship *Unicorn*, from Boston for New Orleans, Oct. 5th, at 9 A. M. got under way, with a fine breeze from W. S. W. and pleasant; at 10·30 A. M. Boston light-house bore N. W. by N. by compass, 2 miles. Noon, fresh breezes and passing clouds, course

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[*] Observations of Prof. SNELL, scale of strength of wind 0 to 6. The storm of 6th, 7th appears hardly to have reached Amherst, as regards the surface wind.

[†] WILLIAM MITCHELL's observations; scale of wind's force 0 to 6.

E. S. E., wind W. S. W.; 3 P. M. Cape Cod light-house bore S. W. ½ S., distant 5 miles; night, wind moderate.

Oct. 6th, begins moderate; 5 A. M. wind W. N. W., course S. by E. ½ E., set studding-sails. Noon, moderate and cloudy, lat. (D. R.) 40° 34′, lon. 69° 6′. P. M. commences light breezes from E. N. E. and cloudy; took in studding-sails and braced on larboard tack, course S. by E.; 4 P. M. wind freshening, took in m. royal and miz. top gt. sail; 6 P. M. in fore and main top gt. sail, sent down m. royal yard and close-reefed the mizen-topsail; 6·30 P. M. gale suddenly increasing, took in jib, spanker, fore and main-courses and mizen-topsail; 7 P. M. gale N. E.; 8 P. M. close-reefed fore and mizen-topsails. At 9 P. M. it was a complete hurricane, blowing the topsails to pieces before we could get them in; also blew the jib from the boom and the staysail from the hanks. At 11 P. M. a heavy sea making and ship rolling heavily, lost quarter boat and shifted the ballast; hove the ship to, head to southeastward. [Midnight, lat. computed, 39° 47′, lon. 68° 56′.]

Oct. 7th, wind commences hauling towards N. W. and blowing a hurricane with a heavy cross sea, ship hove to under a tarpaulin in the mizen rigging; tried to bend mizen-staysail, but found it impossible; forenoon more moderate; at 10 A. M. kept off S.; set reefed courses, bent and set staysails. [Noon, computed lat. 39° 33′, lon. 69° 3′.] P. M. commences with wind settling at N. W.; unbent fragments of topsails, bent new ones and set them double-reefed; course S. by W. Night more moderate; made sail accordingly. [Next 12 hours pleasant, wind W.]

120 *b*. Brig *Corvo*, took the gale at 11 P. M. of the 6th, in lat. 39° 40′, lon. 68°; was on her beam ends two hours; main-topsail and foresail blown away when furled snug in the yards. [103 miles L. of axis line.]

121. Ship *Sarah & Arsilia*, for Havre, Oct. 6, A. M., moderate; noon, heavy rain in squalls from S., lat. D. R. 39° 20′, lon. D. R. 67° 38′; [103 miles L.;] P. M. begins wind S. E.; at 2 P. M. freshening, double-reefed the topsails; 4 P.M. blowing a gale from E. S. E., close-reefed the topsails and reefed the foresail; at 7 P. M. the gale had veered to E. N. E., and at 8 P. M. hove the ship to, blowing violently; at 11 P. M. blowing a hurricane. Oct. 7th, at 2 A. M. the hurricane shifted rather suddenly to N. E.; at 2·30, shipped a heavy sea, stove bulwarks, &c.; [(?) 50 miles L.;] 8 A. M. gale still heavy from N. E.; 10 A. M. N. N. E., commenced scudding; at 1 P. M. wind had veered to N. W., strong gales and clear weather with a high sea, set close-reefed fore-topsail and reefed foresail; 6 P. M. more moderate, shook out one reef; midnight, still moderating, set top gt. sails over single reefs. Oct. 8th, moderate breezes from W. N. W., lat. 40° 34′, lon. D. R. 64° 32′. [12 miles L. This vessel was in the Gulf Stream, which, with her general course eastward, prolonged the duration of the gale.]

122. Ship *Zurich*, Oct. 6th, lat. 40° 27′, lon. near 67°, [140 miles L.,] calm; 2 P. M. N. E., moderate; 4 P. M. E., freshening; 8 P. M. gale N. E., scudding, double-reefed topsails, took in jib and mainsail. Oct. 7th, 3 A. M. gale still increasing, split the foresail; 4 A. M. hove to; 8 A. M. gale had veered to N. W.; 11 A. M. bent a new foresail and made sail, winds more moderate with heavy sea; noon, lat 39° 30′, lon. 68° 30′, [115 miles L.]

123. Ship *Courier*, for Gibraltar, Oct. 6th, A. M. wind W. to E. N. E., light, lat. 39° 43′, lon. 67° 19′, [80 miles L.] P. M. commences with fresh gales from E. N. E.; 2 P. M. in top gt. sails; 3 P. M. double-reefed the topsails; 4 P. M. close-reefed, gale still increasing, course S. E. by S. upon the wind; 6 P. M. reefed the foresail and hove to; heavy sea breaking over the ship; latter part heading E., gale having veered to N. E. and N. N. E. and increased to a full hurricane. [(?) 40 miles L.] Oct. 7th, a tremendous hurricane; at 4 A. M. wind was N. W. with rain, having hauled from N. E. during the night; 8 A. M. gale abating; 10 A. M. bore away and set reefed foresail, a heavy sea on; noon, lat. 39° 25′, lon. 66° 25′, [29 miles L.] At 1 P. M. gale N. W., set mainsail; 5 P. M. out one reef of main-topsail; 8 P. M. set jib and spanker, blowing in squalls, with a heavy sea; latter part moderate. At 2 A. M. Oct. 8th, out reefs and set topsails.

124. Ship *Nathaniel Hooper*, sailed from Boston Oct. 5th; noon of 6th, lat. obs. 40° 58′, lon. (chr.) 68° 21′, calm; P. M. course S. W., winds N. E., increasing; 5 P. M. in all light sails; 7 P. M. wind increasing to a gale, shortened sail and close-reefed topsail; 10·30 P. M. gale increasing, with rain in torrents, took in mizen-topsail, and while handing fore-top-

sail gale increased to a tornado and caused the ship to broach to; it blowing a perfect hurricane which tore all the sails into ribbons, blowing them from the gaskets; a tremendous sea, occasionally breaking over the ship. Oct. 7th, [about 152 miles L.,] blowing a hurricane, ship lying to; up N. E., off E.; at 11 A. M. gale abating, still lying to, with a N. N. W. gale; at noon wore ship to S. W.; lat. (D. R.) 39° 54′, lon. 68° 48′; P. M. strong gales N. N. W. and cloudy; ends with light winds from N. W. Oct. 8th, noon, lat. 38° 44′, lon. (chr.) 69° 35′. Capt. CHURCHILL states that his barometer fell to 28·40, [add index error ·20=28·60,] and that three of the ships which left Boston in company with the *N. H.* returned to port dismasted.

125. In Boston Bay [about 318 miles L.] the gale was severe at N. E., and several vessels were driven on shore during the night of the 6th, near Point Alderton, at Scituate, &c.

126. Watertown Arsenal, Mass., lat. 41° 21′, lon. 71° 12′, [352 miles L.,] Oct. 3d, winds S. E., 2; 9 P. M. S. E., 3, and clouds from S. E. Oct. 4th, A. M. S. E.; 3 P. M. S. W., 2; 9 P. M. N. W. 2; (rain from 3 P. M. 3d, to 1 P. M. 4th.) Oct. 5th, sunrise, W., 2; 9 A. M. S. W., 3; 3 P. M. S. W., 5; 9 P. M. N. W., 1. Oct. 6th, A. M. W., 2; 3 P. M. N., 2; 9 P. M. N. E., 3. Oct. 7th, sunrise, N. E., 1; 9 A. M. N. W., 2; 3 P. M. W., 1; 9 P. M. N. W., 2; rain from 10 P. M. 6th to quarter past 1 P. M. 7th, 0·74 in.

To this may be added the following barometrical observations of R. T. PAINE, Esq., at Boston, made at sunrise, half past 2 P. M., and 10 P. M. Oct. 1st, 30·23, 30·37, 30·38. Oct. 2d, 30·40, 30·39, 30·34; 3d, 30·24, 30·08, 29·96; 4th, 29·80, 29·47, 29·48; 5th, 29·48, 29·60, 29·79; 6th, 29·92, 29·90, 29·79; 7th, 29·82, 29·86, 30·03; 8th, 30·05, 30·05, 30·06.

127. Fort Constitution, Portsmouth, N. H., lat. 43° 03½′, lon. 70° 43, [364 miles L.,] Oct. 6th, A. M. winds N., 2, N. W., 1, halo; P. M. E., 2, N. E., 5. Oct. 7th, winds N., 3; rain 0·38 in.

At Saco, Me., about 30 miles N. of Portsmouth, the barometrical observations of J. M. BATCHELDER, taken at 7 A. M., 2 P. M., and 7 P. M., at 65 feet above high water, were as follows, viz.—Oct. 1st, 30·31, 30·32, 30·37. Oct. 2d, 30·39, 30·26, 30·34; 3d, 30·32, 30·17, 30·12; 4th, 29·84, 29·59, 29·57; 5th, 29·56, 29·56, 30·14; 6th, 29·93, 29·96, 29·97; 7th, 29·86, 29·93, 29·94; 8th, 30·06, 30·07, 30·04.

128. At Hanover, N. H., on the Connecticut, lat. 43° 41′, lon. 72° 22′, [460 miles L.,] Oct. 2d, bar. 30·08 to 29·88, winds N. W., S. W., S. E. Oct. 3d, bar. 29·76, 29·60, winds S. E., rain from 8 P. M. Oct. 4th, bar. 29·40, 29·11, winds S. E. at sunrise, S. W. at half past 1 and half past 9 P. M., (rain to 3 P. M., in all 2·85 in.) Oct. 5th, bar. 29·10, 29·44, winds S. W., N. W., (bar. 29·09 at 9 A. M. and sprinkling of rain 10 A. M.) Oct. 6th, bar. 29·59, 29·52, winds N. W.; N. at half past 9 P. M. 7th, sunrise, bar. 29·45, half past 1 P. M. 29·59, half past 9 P. M. 29·71, winds N., rain from 3 P. M. 0·02 in. Oct. 8th, A. M. bar. 29·70, 29·72, winds N.; half past 9 P. M. winds S. W., barometer falling. [From these observations of Prof. YOUNG and those of Prof. SNELL at Amherst, it appears that the strength of this second storm, as one either of wind or rain, did not reach the valley of the Connecticut, although barometrically, its influence was more widely extended.]

129. Ship *Mediator*, for London, Oct. 6th, noon, lat. obs. 40° 20′, lon. (chr.) 65° 36′, [40 miles L.,] wind N. E.; commenced blowing at 2 P. M.; at 4 P. M. blowing hard; 6 P. M. under close-reefed topsails; 10 P. M. very heavy gale, hove the ship to, with head still to southward; midnight, wind E. S. E. Oct. 7th, commences with gale still increasing; 3 A. M. wind had hauled to S. E.; [ship now near the axis line of the gale;] 4 A. M. gale, S. S. W.; 6 A. M. gale S. W. by W., still blowing hard; 8 A. M. wind W.; 9 A. M. N. W. by N.; 11 A. M. N. W., and continued to blow in that quarter; noon, lat. 40° 32′, lon. 61° 36′. [98 miles R. of axis line; having crossed the same during the gale. This accounts for the veering of the wind by the S., as the gale passed over, instead of by the N. as on the L. side.] Capt. CHADWICK states that his barometer fell as low as 28·20, of which he is certain, and he thinks lower, previously to 4 A. M. [This barometer reads 0·08 in. lower than my own, giving 28·28 in. for the above observation.]

130. Ship *St. Nicholas*, for Havre, Oct. 6th, lat. 40° 30′, lon. 66° 20′, wind E., cloudy, course S. S. E.; 5 P. M. [25 miles L.] commences blowing strong from E. N. E. with rain; 6 P. M. double-reefed; 7 P. M. in fore and main-topsail and mainsail; 8 P. M. blows tremendously, hove the ship to under close-reefed main-topsail, head S. S. E., [wind about

E.;] 11 P. M. gale S. E. Oct. 7th, at 2 A. M. wore ship to N. E.; about 3 P. M. *wind abated at S. E. and came out light from N. W.*, which suddenly increased to a tremendous gale; hove the ship to, sea running high from the old quarters and making a clear breach over the ship; 8 A. M. kept away before the wind; noon, weather moderated and all sail set, lat. 39° 40′, lon. 64° 45′, [31 miles R.] Oct. 8th, lat. 40° 40′, lon. 62° 40′, Capt. PELL states that between 1 and 4 A. M. his barometer had fallen to or below 28·20; the lowest he had seen it, except in the gale in which the steam-ship *President* was lost. [Its error being 0·17 in. gives 28·37 in., corrected.]

The *Cambridge*, for Liverpool, was in company with the *Mediator* before the gale, and in like manner with that ship and the *St. Nicholas*, crossed the axis line during the gale and had the wind veer by the South, as follows:

131. Ship *Cambridge*, Oct. 6, P. M., wind freshening from E. N. E., veering to E. S. E., ship's course S. E. to S.; at 4 P. M. topsails were double reefed; 6 P. M. close reefed; furled foresail; gale increasing. October 7th begins by wearing ship to the E. under close reefed main-topsail and main spenser; wind increasing; at 2 A. M. a complete hurricane; blew away the main-topsail; wind hauling gradually from S. S. E. to westward; at 7 A. M. bore away* under close reefed fore-topsail; 10 A. M. set the foresail; at 6 P. M. more moderate. The mate states that the wind hauled gradually from S. S. E. to S. W. and the westward.

132. Brig *Mentor*, for Guadaloupe, Oct. 6, lat. 40° 30′, lon. 65°, [24 miles R.] light winds from N. and E. and heavy sea. Towards evening wind increased, and before 10 P. M. a heavy gale set in blowing from S. E.; 11 P. M. hove to. October 7th, gale increasing, and before 4 A. M. blew a hurricane; by 6 A. M. every mast and spar was blown from the wreck.

133. Ship *Roscius*, for New York, took the gale off N. E. end of George's Shoal, near lat. 41° 10′, lon. 65° 50′, [about 85 miles L.] on the 6th, about 6 or 7 P. M., from E. N. E. The gale was heaviest about 1 A. M. of the 7th, when the barometer stood somewhat below 28 inches, but soon rose, and the gale veered suddenly to N., and thence gradually to the northwestward. At the commencement of the gale on the evening of the 6th, the barometer stood at about 29·70. [Its index error, I am told, was two or three tenths; corrected minimum, say 28·25 inches.]

134. Ship *Rochester*, Oct. 7th, lat. 42°, lon. 67°, [182 miles L.] experienced a severe gale from N. E.; lost main-topsail, foresail, &c., and sprung fore and main masts.

135*a*. Fort Preble, near Portland, Me., lat. 43° 30′, lon. 70° 20½′, [368 miles L.] Oct. 2d, average of barometer, 30·249; Oct. 3d, 30·155; Oct. 4th, 29·739, wind S. E., 6 to 8, rain from 7 P. M. of 3d to 4 P. M. of 4th, 0·90 inches; Oct. 5th, bar. 29.535, 9 P. M. 29·717, winds, A. M., S. W., 3, 4; P. M., W., 6, 4, 1. Oct. 6th, sunrise, bar. 29.937, wind S. W., 2; 9 A. M. bar. 30·059, wind S. W., 1; 3 P. M. bar. 30·055, wind S. W., 1; 9 P. M. bar. 29·977, wind, S. E. (?) 6. Oct. 7th, sunrise, bar. 29·736, wind N., 6; 9 A. M. bar. 29·862, wind N. W., 4; 3 P. M. bar. 29·961, wind N., 4; 9 P. M. bar. 30·032, wind N. E., 1; light rain 7th, from 6 A. M. to 6 P. M., 0·14 inches.

135*b*. The following observations were made at Hampden, Me., on the Penobscot River, 180 feet above tide, lat. 44° 42′, lon. 68° 56′. From journal of J. HERRICK.

Oct.	Barometer.				Ther.	Wind, and its force.†				Clouds, velocity and course from.			
	S. R.	9 A. M.	3 P. M.	9 P. M.	Mean.	S. R.	9 A. M.	3 P. M.	9 P. M.	S. R.	9 A. M.	3 P. M.	9 P. M.
2	30·24	30·29	30·24	30·40	38·75	N. W. 1	S. W. 1	S. S. E. 2	S. W. 2		Smoky.	Hazy.	
3	30·26	30·23	30·10	30·10	47·75	S. E. 1	S. E. 2	S. E. 3	S. E. 2		S. E. 2	S. E. 3	S. S. E. 2
4	29·88	29·88	29·54	29·30	55·75	S. S. E. 6	S. S. E. 6	E. 6	E. 1	E. 6	S. E. 8	E. 8	
5	29·29	29·30	29·27	29·48	54·75	S. 1	S. 3	N. W. 3	W. 2		S. 3	N. W. 3	
6	29·80	29·83	29·83	29·84	49·75	S. W. 1	N. W. 2	N. W. 2	W. 1		N. W. 2	S. E. 3‡	
7	29·65	29·70	29·87	29·94	42·25	N. W. 6	N. W. 4	N. W. 3	N. 2	N. E. 6	N. N. E. 4	N. W. 3	W. 2
8	30	30·03	29·90	29·90	43·75	N. W. 1	S. W. 1	S. W. 1	S. W. 1	N. W. 1	N. W. 3	N. W. 2	N. W. 1

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* The sea terms, "*bear up*" and "*bear away*," have but one meaning among our seamen. The latter term, though not accordant with authority, seems best to express the idea of sailing off from the wind; the former refers to the act by which the result is produced.

† **Formulary of the Surgeon General's office.** ‡ **High current.**

Oct. 4th, at 5 A. M., wet; frequent showers with violent wind in short gusts; continued to blow hard with slight rain to 11 A. M., when the storm commenced with great violence; from 11 A. M. to 8 P. M. there fell 0·95 inches of rain; 2 P. M. thunder shower N. W. Oct. 6th, high current from S. S. E. all day; low clouds from N. W. Oct. 7th, at 6 P. M. a pause; from 9 A. M. to 9 P. M. 0·54 inches of rain fell. During the progress of this storm [night of 6th and 7th] the low wind has been from N. W. with a rising barometer, and a higher current from S. S. E. [The lower or *scud cloud*, however, has shown here the true course of the wind in the *storm stratum*, and conformably to the barometric changes; see table. Both here and in Massachusetts, the old N. W. surface wind of the 5th appears to have intruded beneath the storm stratum, nearly or quite to the sea coast.]

136. At Yarmouth, Nova Scotia, lat. 43° 51′, lon. 66° 05′, [28 miles N. W. from Cape Sable, and 225 miles L.] a heavy gale commenced at 11 P. M. Oct. 6th, from N. E., and at 11 A. M. of the 7th, veered to N. W. Vessels in port damaged and driven on shore.

137. Ship *St. Petersburg*, Oct. 6th and 7th, Cape Sable N. W. 25 miles, [lat 43° 05′, lon. 65° 14′, about 152 miles L.] experienced a gale from E., lost topmasts and mainsail. [It must be inferred that this position, west of the ship's proper track, was at the close of the easterly part of the gale, and that the vessel was much nearer the axis line in the early part of the storm. Close of the gale not mentioned.]

138. Fort Sullivan, Eastport, Me., lat. 44° 53′, lon. 67°, [310 miles L.] Oct. 4th, winds E., 4, 5; 9 P. M., N. E., 6; 5th, S. E., 1, S. W., 3, 4, W., 2; rain from 1 P. M. of 4th, with high winds—rain, ending 2 A. M. of 5th, 2·10 inches. Oct. 6th, A. M., winds W. 2.; P. M., N. W., 1, 0. Oct. 7th, sunrise, wind N. E., 6; 9 A. M., N., 4; 3 P. M., N. W., 3; 9 P. M., N. W., 3; rain from 2 A. M. to 10 P. M., 0·55 inches.

139. At Hancock Barracks, Holton, Me., lat. 46° 5′, lon. 67° 40′, [390 miles L.] Oct. 2d, average of bar. 29·593: 3d, 29·68: 4th, A. M., 29·576, wind E., 4, 5; 2 P. M. 29·209, wind E., 6; 9 P. M. 29·075, wind E., 6; rain from 1½ P. M. ending in night, 0·54 inches: 5th, A. M., 28·862, wind S. E., 3, S., 4; P. M. 28·835, wind S., 5, 3, showery. Oct. 6th, sunrise, bar. 29·063, wind S. W., 3; 10 A. M. 29·099, wind N. W., 3; 2 P. M. 29·205, wind W., 2; 9 P. M. 29·205, W., 2: 7th, sunrise, 29·142, N. E. 4; 9 A. M. 29·177, N. E. 4; 2 P. M. 29·142, N. W., 3; 9 P. M. 29·236, N. W., 3; rain from 11 A. M. to 4 A. M. of 8th, 0·70 inches, [apparently within the range of the two storms.]

140. At Fort Kent, Me., lat. 47° ? lon. 68° 20′ ? [about 460 miles L.] Oct. 4th, wind S. E., 1, 2; 5th, N. E., 1, 2, W. 2; rain from 3 P. M. of 4th to 11 A. M. of 5th, 0·84 inches; 6th, N. W., 3, 2, 1, showers in night, 0·03 inches. Oct. 7th, A. M., N. E., 2; 2 P. M., N., 2; 9 P. M., N., 1; rainy from 3 P. M. to 5 P. M., 0·02 inches. Aurora in the evening. [No gale here, but the more moderate influence of both storms is distinctly seen.]

141. H. M. ship *Illustrious*, Ad. Sir CHARLES ADAM, in Halifax harbor, lat. 44° 36′, lon. 63° 28′, [168 miles L.] Oct. 4th, A. M., (first 12 hours,) bar. 30·29 to 30·05; winds from E. S. E., 4, 5, c., to S. by E., 6, c. q.; P. M. bar. 30·01, to 29·80 at 10 P. M.; winds S. by E., 6, S. E., 7, E. S. E., 8, E. by S. 9, 7; rain from 6 P. M. Oct. 5th, bar. 2 A. M. 29·50; 10 A. M. 29·54, noon, 29·60; winds, 2 A. M., S. E., 5, o. c. q.; 4 A. M., W., c. o.; 6th A. M., S. W., 3, o. t.; 10 A. M., S. W., 2; 2 P. M. bar. 29·51, 10 P. M., 29·56; winds, W. S. W., 3, 4 o. c.; 6 P. M., S. W., 4, 2, c. Oct. 6th, A. M. bar. 29·59 to 29·75, P. M. 29·78 to 29·83; winds A. M., S. W., N. W., 3, 2, b. c., c. f.; P. M., N. W. to N. N. W., 3, 2; ends calm. Oct. 7th, bar. 2 A. M. 29·76; 4 A. m., 29·76; 6 A. M. 29·56; 8 A. M. 29·50; 10 A. M. 29·40; noon 29·23; 2 P. M. 29·38; 4 P. M. 29·33; 6 P. M. 29·40; 8 P. M. 29·48; 10 P. M. 29·59; 12 P. M. 29·73: winds, 2 A. M., N. Easterly, 4, c.; 4 A. M., N. E., 5, c. r.; 6 A. M., E. N. E., 6, q. r.; 8 A. M., E. N. E., 7, q. r.; 10 A. M., N. E., (northeasterly,) 8, q. r.; noon, N. Easterly, 8, q. r.; 2 P. M., N., 6, o. q. r; 4 P. M., N., 6, o. q. r.; 6 P. M., N. Westerly, 5, c. q., and the same to midnight. Oct. 8th, A. M., bar. 29·74 to 29·88; winds N. W., W. N. W., N. W., 6, 5, 2, 4, c. o., b. c,; P. M., bar. 29·88; winds W. N. W., 4, 2, 1. [According to the barometer, the axis of the gale appears to have been opposite to or S. E. of Halifax about noon of 7th, or soon after.]

142. H. M. ship *Scylla*, at and from Prince Edward's Island, Gulf of St. Lawrence, Oct. 2, A. M., winds N. W. to W. N. W., 4, c., bar. 30·20; P. M., running for Pictou and anchored under Pictou islands; winds W. N. W., S. W., 4, 3, 2. Oct. 3d, running for

Cape St. George; A. M., winds W., S. W., S., S. S. E., 2, b. c., bar. 30·40: P. M., winds S. by W., 3, S. S. E. and S. E., 4, b. c.; anchored under shelter of Cape St. George. Oct. 4th, weighed for Gut of Canso; 2 A. M., winds S. E. by S., 5, 6, b. c.; 6 A. M., S. E. by E., 6, 7, b. c. q.; 11 A. M., S. E., 6, b. c.; bar. 30·20: P. M., winds S. S. E., 7, c. g. q.; 5 P. M., S. S. E., 7; ends S. S. E., 7, c. g. r.; strong gales and heavy rain. Oct. 5th—for and in Gut of Canso; 1 A. M., winds S. E. by S., 8, c. q. r.; 4 A. M., S. S. E., 6, q.; 6 A. M., S., 5, c. b.; 8 A. M. S. W. 4, b. c.; noon, W. by S., 3, bar. 29·30: P. M. winds W., 1 to 5, b. c.; anchored in Ship Harbor, Gut of Canso. Oct. 6th, A. M., winds W., 2, 5, bar. 29·75: P. M., winds W., 4, 3, 2; calm, easterly, 2, b. c.; ends off Cape Canso.

Oct. 7th, running from Cape Canso for Halifax, wind easterly, 4, b. c.; lost sight of light at 1·15 A. M.; 4 A. M. wind 6, b. c.–c. r.; at 6·30 double reefed fore and three reefed main-topsail; 6 A. M., E. by N., 6—9, o. r. c.; at 9·30 furled topsail, down top-gallant yards and housed top-gallant masts; 10 A. M., gale 10, q. r. c.; at 11 gale E. N. E., 10; hove to on larboard tack; course from 4 to 11, W., 8 to 11 knots; noon, gale 10; bar. 28·90; Sambro Light, N. 82, W. 25 miles. [Lat. 44° 21′, lon. 63°, 132 miles L. The westward run from off Cape Canso increased the distance from the axis line, and appears to have produced a change of one or two points in the direction of the gale.] P. M., lying to, struck mizen-topmast; 2 P. M., gale N. E., 9, o. g. r.; 4 P. M., 9, 8, o. g. r.; 6 P. M., N. W. by N., 8, o. g.; from 9 to 12, N. W. by W., 8, 7, o. g. Oct. 8th, A. M., winds N. W., 6, 6, 5, W. N. W., 4, c. g., c.; at 5 A. M. began to make sail; noon, bar. 29·90: P. M., winds W. N. W. to W., 4, 3, 4, b. c.; ends with Sambro Light 8 miles distant.

143. Schr. *Actress*, in Little Canso Harbor, S. E. point of Nova Scotia, lat. 45° 20′, lon. 60° 58′, [about 98 miles L.] gale commenced nearly at S. E., and after blowing near 12 hours hauled steadily by the N. to N. W.

144. H. M. ship *Pique*, Capt. M. STOPFORD, Gulf of St. Lawrence, Oct. 6th, 4 A. M., bar. 29·36, wind N. W. by N. 4; noon, lat. 47° 59′, lon. 63° 18′, bar. 29·65, winds N. W. by N., 5; 3 P. M., W., 4, b. c., bar. 29·75; 8 P. M., N. W., 4, bar. 29·90; 10 P. M., N. E., 2; midnight, E., 3. Oct. 7th, 3 A. M., wind E. by S.; daylight, land of Cape Breton Island on the weather bow; 7·20 A. M., single reefed; 8 A. M. bar. 29·63, wind S. E. by E. (magnetic) 5, c. r. m.; 9. A. M., bar. 29·54; in top-gallant sails, close reefed the spanker, down jib; 9·30, island of Justicoe bore E. S. E. one mile, in 2d reefs; 10·30, tacked; run for and at 11 A. M. anchored under the island, wind E. by N. 7, c. r. g.; [Justicoe, or Just au Corps, is in lat. 46°, lon. 61° 37′, about 135 miles L.] noon, bar. 29·40; 1 P. M., wind E. N. E., 7, o. g. r. f; bar. 29·29; 2·15 P. M., wind 8, weighed anchor and run for Gut of Canso under courses, staysail, and close reefed spanker; 3 P. M., bar. 29·19, wind N. E., 10, o. m. d. q.; [at or near crisis of gale, about 120 miles L.] 3·15, split and blew away part of the foresail; 4 P. M., wind N. E., 9, o. q., split main-staysail; 4·30, came to anchor 4 miles within the Gut of Canso, [say lat. 45° 39′, lon. 61° 23′, about 120 miles L.]; 5 P. M., bar. 29·29, wind N. E., 8, q. m.; 6 P. M., wind N., 7; 7 P. M., N., 6, c. q.; 8 P. M., N. by W.; 9 P. M., N. by W., 5, m., bar. 29·48; 10 P. M., N. W., 6, m. r. q.; midnight, N. W., 6, b. q. m. Oct. 8th, 2 A. M., wind N. by W., 5, c. q. r.; 4 A. M., bar. 29·77; 6 A. M., N. W., 6, c. q. r.; 8 A. M., W. N. W., 5, b. c. q., bar. 29·87, weighed anchor and made sail out of the Gut; 10·30, anchored in Inhabitants Bay [lat. 45° 34′, lon. 61° 16′;] noon, bar. 29·85, wind N. N. W., 5, b. c. q. r.; P. M., wind N. N. W. to W.

The *Pique* also encountered the gale of the 4th and 5th, in the St. Lawrence, but I have no copy of the log for this period.

145. Schr. *Normal*, sailed from the Labrador Coast, Oct. 6th, with a fresh breeze from N., bound for St. Johns, N. F. The wind freshened during the following night, and hauled to E. N. E. October 7th, it increased gradually to a gale from E. S. E. Could not weather Cape Bonavista, and having split the sails, bore away for shelter among the islands in the bay and repaired damages, [about lat. 48° 45′, lon. 53° 45′, 36 miles L.? Mag. var. about 25° W.] At this anchorage the gale is said to have changed by the N. to N. W.

Having thus followed the gale on the left side of its axis to the extent of our reports, we now resume the accounts from the right side of the storm, from Bermuda onward.

146. Ship *J. N. Cooper*, bound for Gulf of Mexico, Oct. 6th, about 1 P. M. the gale had commenced blowing hard from S. E. by E., which in hauling to S. S. E. increased to a furious hurricane, in which all the spars were blown off the ship except the lower masts. The wind had continued hauling to S. S. W., at which point the force of the hurricane began to abate, and the gale continued hauling to S. W. and thence to N. W., ending about midnight. The greatest force of the hurricane lasted about five hours. Position near the close of the hurricane lat. 35° 50′, lon. 69°, [25 miles right of axis line; ship further from this line in the earlier part of the gale.]

148. Brig *Wakulla*, for New York, Oct. 6th, 3 A. M. wind S. S. E., light, freshening in the forenoon, with clear weather; noon, lat. 35° 36′, lon. 66°, [148 miles R.;] P. M. begins with strong gales from S. S. E., took in light sails; 3 P. M. gale increasing, double-reefed topsails, barometer rapidly falling; 6 P. M. heavy gale, close-reefed topsails, took in mainsail and jib; 9 P. M. blowing a hurricane from S., took in fore-topsail and foresail, and hove to at 10 P. M. head to eastward. Oct. 7th, at 1 A. M. the vessel was forced on her beam ends, yards broke and sails blew to pieces, hurricane still blowing with inconceivable fury; soon after 2 A. M. it began to abate a little in its force, till at half past 3 A. M. it suddenly changed and came in its full strength from N. W., [20 miles R. (?)] In about 2 hours afterwards it began slowly to abate, so that at 8 A. M. we set a reefed foresail and close-reefed fore-topsail. The gale lasted till noon, when we observed in lat. 36° 41′, lon. 67° 30′. [47 miles R. At the change of the gale the vessel must have been further to the N. W.]

Near midnight on the 6th, Capt. MULFORD saw that his barometer had fallen to about 27·50. [Add adjustment error 0·15, and for assumed error of observation say 0·10=27·75 in.] The weather was not cloudy in the commencement of the gale, nor so long as the spray blown from the sea permitted observation. Nor at this time was the sea heavy, being blown off comparatively smooth by the violence of the wind, which blew with a force surpassing previous belief or conception.

149. Brig *St. Lawrence* was dismasted in a hurricane Oct. 6th, lat. 36° 50′, lon. 67° 2′. [65 miles R.]

150. Brig *Charles*, took the gale Oct. 6th, in lat. 37° 50′, lon. 67°, [35 miles R.,] was hove on beam ends, lost mainmast, fore-topmast, &c.

151. Barque *Elvira*, for Philadelphia, Oct. 6th, in lat. 38° 10′, lon. 66° 30′, [22 miles R.,] experienced a tremendous hurricane from S. to S. S. W. [This vessel was bound to the N. W., and the position is probably that of noon after the gale. Like the *Wakulla*, on the same course, she probably took the gale at a much greater distance from the axis line, and seems to have reported only the hurricane portion of the gale.]

152. Whaling ship *Nye*, for the Pacific Ocean, took the gale of Oct. 6th, in lat. 38° 58′, lon. 65°, [47 miles R.,] from S. E., with rain, lay to heading S. W.; 8 P. M. took in storm-staysail; gale increasing till 1 A. M. of Oct. 7th, when the ship became disabled, and sails blown in tatters; at 8 A. M. gale abated.

153. Whaling ship *Mt. Vernon*, for the Pacific, Oct. 6th, lat. 39°, lon. 66°, [6 miles R.;] 6 P. M. wind E., stormy indications; bar. fell and wind increased during the evening. From midnight till 4 A. M. of the 7th it blew a perfect hurricane, when it suddenly shifted to S. and S. W. and settled at W., blowing if possible harder than before; at 8 A. M. of the 7th it was moderate; lost all her masts and otherwise injured. [The sudden shift of the wind shows the ship to have been near the axis of the gale.]

It has been seen that three ships, cases 129 to 131, first took the gale on the left side of its axis path, and crossed the same in front of the axis, which brought them into the right side of the gale where it veered by the S. to the W. Our next three cases on this side, will be nearer the right border of the gale.

154. Brig *Lowell*, from Tobasco to Marseilles, Oct. 5th, lat. 33° 46′, lon. 64° 40′; P. M. good breeze from S. W., overcast; midnight, moderate breezes and passing clouds. Oct.

6th, 5 A. M. wind S., increasing; 9 A. M. veered to S. E. quarter, took in top gt. sails, brisk winds and clear weather; noon, lat. 34° 18′, lon. 62° 30′, [372 miles R.,] going 8½ knots. P. M. wind S., strong, with clear weather, all drawing sails set; 8 P. M. wind increasing, in top gt. sails; 9 P. M., wind S. S. W.; midnight, strong wind and clear weather, sea making fast and had caused the brig to spring a leak. Oct. 7th, 1 A. M. wind S. W., very strong; 1·30 A. M. split the jib and took in the topsail, wind blowing a gale, which continued till 7 A. M., [then about 443 miles R.,] when it began to moderate; wind S. W., set fore and main-topsails; noon, strong winds and passing clouds, lat. obs. 35° 33′, lon. 58° 40′, [462 miles R.] P. M. more moderate, with appearance of rain; 5 P. M. winds baffling, brig laboring heavily in a very high sea; 7 P. M. wind W.; 11 P. M. moderate, at W. N. W. and cloudy weather. [The full extent of the gale on this side, from the axis line, probably exceeded 500 miles.]

155. Barque *Wm. Engs*, for New York, Oct. 1st, lat. 37° 20′, lon. 48° 44′; P. M. brisk breeze from N. N. E. and squally. Oct. 2d, lat. 36° 47′, lon. 52° 30′, brisk breeze from N. N. E.; midnight, N. E. Oct. 3d, lat. 37° 01′, lon. 56° 30′; P. M. N. E., fair; 4 P. M. wind E.; midnight, E. S. E. Oct. 4th, A. M. wind hauling S. E.; noon, lat. 37° 21′, lon. 59° 51′; P. M. wind increasing; at 8 P. M. obliged us to double-reef; midnight, close-reefed, wind hauling gradually to S. with an unusual heavy sea from S. Oct. 5th, at 6 A. M. wind had hauled to S. W., and blew a smart gale of wind; carried storm spensers, close-reefed main-topsail and reefed foresail, by the wind; noon, lat. 37° 18′, lon. 60° 11′, blowing in squalls from S. W.; 4 P. M. more moderate, made sail; midnight, calm, and light airs from S. W.

Oct. 6th, noon, lat. 37° 10′, lon. 60° 29′, [316 miles R.,] winds S. W., fair; 8 P. M. strong from S. W., took in sail; midnight, heavy gales from S. W., with heavy sea from S. Oct. 7th, 3 A. M. gale so increased as to compel us to heave to, after which it gradually hauled to W. and N. W., blowing a heavy gale; P. M. gale continues with a heavy sea, had veered to W. N. W.; at 6 P. M. began to moderate, and at midnight fell calm.

156. Barque *Charleston*, for New York, Oct. 4th, lat. 38° 1′, lon. 51° 42′; 4 P. M. wind S. E., single-reefed topsails; 6 P. M. double-reefed, furled foresail, mainsail and jib, gale S. E., and rain. Oct. 5th, wind S. S. E., moderating, lat. 36° 55′, lon. 55° 28′. Oct. 6th, noon, lat. 37° 38′, lon. 57° 55′, [391 miles R.,] winds S. W., moderate; 5 P. M. increasing; 8 P. M. S. W., do.; double-reefed topsails, furled mainsail and jib; 10 P. M. gale at S. S. W., increasing, close-reefed topsails and furled foresail. Oct. 7th, gale continues; 6 A. M. S. W. by S., furled fore-topsail; 9 A. M. W. S. W.; noon, lat. 37° 54′, lon. 59° 57′, [304 miles R.,] gale continues from W., lying to under close-reefed main-topsail; 6 P. M. moderating; 7 P. M. set fore-topsail; 10 P. M. set foresail and mainsail. [This vessel was two days behind the *Wm. Engs*, on a more northern track, and at noon of 6th was 150 miles more eastward than the latter.]

Capt. CATERMOLE states that in the night of the 6th, his barometer had fallen to 28·10,[*] attended by a continued roar in the air; soon after, the hurricane struck the ship with tremendous force from a point E. of S.; afterwards veering gradually to S. S. W., W. and W. N. W.

157. Sloop *Hellespont* encountered the hurricane lat. 40°, lon. 63° 30′, and was thrown on her beam ends. The wind veered from S. S. E. towards S. W., and the sympiesometer fell to 28·50 in., [57 miles R.]

158. Ship *Sheridan*, for Liverpool, Oct. 6th, lat. 42°, lon. 62°; P. M. wind W., 6 knots; 6 P. M. N., 5 knots, course E. by S.; 11 P. M. wind E.; midnight, tacked ship, wind increasing, [75 miles R.] Oct. 7th, double-reefed topsails; 4 A. M. fresh breezes from S. and rain; 6 A. M. out one reef; 7 A. M. wind S. S. W., continues fresh gale and high sea; noon, lat. 42° 40′, lon. 58° 30′, 116 miles R.;] P. M. blowing strong from S. W.; [probably opposite the axis of the gale about 3·30 P. M., then 140 miles distant;] 9 P. M. wind W.; midnight blowing strong from W. Oct. 8th, daylight, strong gale and heavy sea; 9 A. M.

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[*] This barometer was left in Europe on the return voyage and could not be examined, but I infer, from the ship's position, that its index error must have been uncommonly large. Capt. C. states, however, that the effect on his sympiesometer was also very great.

wind W. N. W.; noon, moderating, lat. 44°, lon. 53° 30′; [270 miles R.;] P. M. strong breeze from W. N. W. and a high sea running; midnight, same. Next day, wind W. S. W. steady.

159. Ship *Memphis*, for New York, Oct. 4th, lat. 42° 38′, lon. 54°, ends with fresh gales from S. E. and heavy rain; in double reefs. Oct. 5th, gale S. E., strong; noon, moderate and a large sea, lat. 42° 48′, lon. 58° 58′; P. M. winds W. S. W. and W. Oct. 6th, A. M. winds W. N. W. and W., lat. 43° 20′, lon 58° 50′; P. M. winds W. and W. by N., fine weather, with a large swell from southward; 10 P. M. a shift of wind to eastward; 11 P. M. E., light airs with rain. Oct. 7th, wind E. S. E., increasing, double-reefed topsail, took in jib and mainsail; 5 A. M. gale S. E., reefed foresail, took in fore and mizen-topsail, heavy gale; 11 A. M. E.; noon, S. E., lat. 43° 16′, lon. 60°, [34 miles R.;] 1 P. M. *violent gale from S. W.*, with a tremendous sea; 4 P. M. wore ship, took in foresail and hove to; boarded heavily by the sea; 6 P. M. gale had veered to W., moderating; 9 P. M. W. N. W.; midnight, gale blowing strong from W. Oct. 8th, at daylight, out double-reefs, set whole courses and jib, wind S. W. by W., with a large sea on, lat. 42° 43′, lon. 60° 20′; P. M. winds W. N. W. and N. W., set top gt. sails.

160. Ship *Europe*,* for New York, Oct. 6th, lat. 44° 57′, lon. 56° 30′, winds S. W. to N. W. Oct. 7th, 4 A. M. wind S. E., light; 8 A. M. strong at S. S. E., took in top gt. sails; 10 A. M. gale increasing, close-reefed topsails, furled jib and mainsail, hard squalls of wind and rain; noon, gale had veered to S., lat. 44° 19′, lon. 58°, [51 miles R.,] gale increasing and at 2 P. M. had backed to S. E., took in main-topsail and foresail; [3·03 P. M. axis of gale perhaps 45 miles distant;] 4 P. M. the gale was heavy from W. S. W., split fore-topsail; 6 P. M. hard gales and tremendous squalls, with a heavy sea, lying to; midnight, gale continues, having veered to W. Oct. 8th, 4 A. M. gale W. N. W; 6 A. M. split the fore-topmast-staysail; 10 A. M. gale abating, set close-reefed fore and mizen-topsails; noon, moderating, a high swell from W. N. W., lat. 43° 35′, lon. 56° 30′; P. M. moderating; at midnight made all sail. The barometer fell very low, both previous to and during the gale.

161. St. Johns, N. F., lat. 47° 34′, lon. 52° 38′, [85 miles, R. (?)] by Mr. TEMPLEMAN, barometric observations taken at 9 A. M. and 9 P. M., the barometer 140 feet above tide. Oct. 3d, bar. 30·25, 30·28; light variable winds and cloudy; P. M. light winds S. E. to S. W. 4th, bar. 30·30, 30·23, light breeze S. S. W. overcast and gloomy; P. M. frequent showers. 5th, bar. 30·05, 29·46, fresh breeze S. S. E., overcast and gloomy; P. M. strong breeze and driving rain; [first Cuba storm;] 9 P. M. fine. 6th, bar. 29·38, 29·60, fresh breeze S. W., cloudy; fine evening. 7th, bar. 29·78, 29·40; light variable winds, overcast and gloomy; 10 A. M. wind E., rain; P. M. wind E. S. E., rain. 8th, bar. 29·33, 29·41, light variable winds, dark and gloomy; P. M. wind fresh from S. W. to W. 9th, bar. 29·48, 29·43, moderate breeze N. W. and cloudy.

The logbook of H. M. S. *Eurydice*, then in the harbor, gives the wind easterly, 5, at the beginning of the 8th; in the second watch [4h. to 8h.] a calm; 3d watch, W. S. W., 2; P. M. W. by S., 3, and W. by N., 4, 5, and 6. Oct. 9th, A. M. W. to N. W., 5; bar., at noon, 29·56. [The harbor of St. Johns, on the E. coast, is deeply sheltered, with a narrow entrance.]

162. Ship *Independence*, for New York, Oct. 5th, lat. 47° 17′; P. M. winds N. W., and W. by N., light; 8 P. M. S. W., ends S. S. W. Oct. 6th, wind strong from S. W.; 2 A. M. furled top gt. sails; 5 A. M. W. S. W., increasing; 6 A. M. close-reefed fore-topsails and courses; 8 A. M. furled fore and main-topsails and mainsail; 10 A. M gale still W. S. W.; noon, heavy gale with rain, lat. 47° 40′, lon. 42° 41′; [first Cuba gale;] 1 P. M. W. blowing heavy; 5 P. M. more moderate, set fore and mizen-topsails.

Oct. 7th, at 7 A. M. wind N. W.; noon, sun obscured, lat. 48° 26′, lon. 43°; P. M. commences blowing fresh from N. W.; 4 P. M. passed steamer *Britannia* from Halifax; wind moderating, made all sail; midnight, wind E. Oct. 8th, *commences with easterly winds;* noon, calm and rainy, lat. 47° 26′, lon. 45° 37′; [280 miles R. (?)] P. M. strong gale from N. W. and W. N. W., double-reefed. Oct. 9th, strong gales from N. W. and W. N. W.; noon, lat. 45° 20′, lon. 46°.

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* Liverpool packet: second ship of this name.

163. Ship *Adirondack*, Oct. 5th, P. M. wind W. by S., light and pleasant; midnight, light winds and clear weather. Oct. 6th, 4 A. M. cloudy, took in top gt. sails; 8 A. M. thick weather with rain, wind S. W., double-reefed the topsails; 10 A. M. reefed, and set mainsail and jib; at noon heavy gales, sail reduced to close-reefed main-topsail, spanker, and main spencer; no observation; P. M. heavy gale from S. W. and thick weather; at 4 P. M. set reefed foresail. [This was the prelusive gale, which in this region was stronger than the succeeding one.]

Oct. 7th, at 1 A. M. wind W. N. W.; 3 A. M. set close-reefed fore and mizen-topsails; 5 A. M. set double-reefed mainsail and jib; 11 A. M. turned close-reefs out of fore and main-topsail, and first reef out of mainsail, lat. obs. 46° 56′, lon. 41° 08′; P. M. wind N. W. by N., under double-reefed topsails and courses; from 2 to 4 P. M. turned out reefs; 7 P. M. set top gt. sails. [End of first Cuba gale.] All night, calm and light airs, with thick, dark and rainy weather. Oct. 8th, 2 A. M. wind at S. E.; 4 A. M. E.; 6 A. M. N. E., and E.; set main top gt. sail; 8 A. M. baffling and squally, wind hauling to southward with rain; double-reefed the courses and spanker and stowed the jib; noon, cloudy, no observation; [about 415 miles R. of axis line;] P. M. wind N. W. by W., fresh gales and cloudy weather; 3 P. M. out reefs; from 3 to 7 P. M. wind went round to S. and E.; 8 P. M. W. N. W.; through the night dark and squally. Oct. 9th, wind W., fresh gales and squally; at 4 P. M. heavy squalls, close-reefed the topsails; 8 P. M. set the main-topsail; through the night clear and cold, with a heavy sea. Oct. 10th, lat. 46° 18′, lon. 47° 44′.

164. Ship *Prince Albert*, for New York, Oct. 4th, A. M. strong breeze N. E. to N., 10 knots; squally and large head sea, pitching heavily and carrying all sail. *Passed large quantities of gulf weed;* noon, lat. 46° 32′, lon. (chr.) 38° 30′; *bar.* 30·24, [its adjustment correct,] air 57°, water 66°; P. M. wind N. moderate, clear and pleasant; 9 P. M. N. N. W. Oct. 5th, wind N., 6 knots; 5 A. M. N. N. W.; 10 A. M. N. N. E., moderate and pleasant; noon, light airs N. N. E., lat. 45° 40′, lon. 41° 36′; 2 P. M. S., 2 knots; 4 P. M. S. S. W., 3 knots; 6 P. M. S. W., 8 knots; 9 P. M. S. W. by S., still increasing; ends strong and squally, double-reefed fore and mizen-topsails. Oct. 6th, begins S. S. W., 9 knots; 2 A. M. S. W., strong, squally, and a large sea; 4 A. M. double-reefed main-topsail and reefed mainsail; at 7 P. M. furled jib and mizen-topsail; noon, strong winds, large sea, and constant rain, lat. 45°, lon. 45° 41′; P. M. wind W. S. W., moderating and constant rain; set single-reefed topsails, jib and top gt. sails; 6 P. M. wind W., latter part fresh breezes and cloudy.

Oct. 7th, A. M. fresh breeze and cloudy, *with large swell from S. W.;* after 4 A. M. out all reefs; [end of first Cuba gale;] noon, W., lat. obs. 45° 30′, lon. 46° 50′; 1 P. M. E., light; at 4, S. S. E., light; at 6 W. by S.; 7 P. M. fresh; in light sails; ends with strong wind, constant rain, and thick fog. Oct. 8th, [325 miles R. from supposed axis line,] wind W., strong, small rain and thick fog; 3 A. M. heavy squalls; in two reefs; 5 A. M. W. by N.; 7 A. M. out one reef and set main top gt. sail; 8 P. M. W. N. W.; 10 A. M. took in top gt. sail; noon, strong winds and heavy sea, ship laboring hard; lat. obs. 45° 6′, lon. chr. 49°; P. M. W. N. W., weather unchanged; 5 P. M. W. by N.; 8 P. M. out all reefs; latter part brisk breeze and clear pleasant weather. Oct. 9th, brisk wind from W. and large westerly swell, ship laboring heavy; 9 A. M. exchanged signals with English ship *Wallace*, steering S. under close-reefed topsails, reefed courses and jib furled; at 11 increasing wind, squally, in top gt. sails; noon, lat. 44° 21′, on the Banks; P. M. fresh wind from W., clear and pleasant, and heavy swell from W. N. W.; latter part light and pleasant.

[The *Prince Albert* is one of the many New York packet ships that are found in the foregoing recitals. Capt. SEBOR's logbook is always kept in civil time; as is the case with some others, also, of these fine vessels. It is hoped that the practice will become universal.]

Further trace of the first storm and also of the progress of the right limb of the second or great gale, is afforded by the log of the R. M. steamer *Britannia*, in her voyage from Halifax for Liverpool, which, on account of the importance of pursuing the inquiry in the higher latitudes and towards Europe, is here subjoined.

165. R. M. steamer *Britannia*, Oct. 3d, 1844, at 12h. 15m. received the mails at Halifax and proceeded to sea; wind S. S. E., increasing; midnight, strong breeze and cloudy.

Oct. 4th, wind S. S. E., strong breeze and cloudy; 9 A. M. strong breeze and weather fine; noon, same, lat. 44° 54′, lon. 59° 10′. Distance run, 196 miles. 1 P. M. strong breeze and clear weather; 3 P. M. wind S. E., increasing; cloudy; 8 P. M. fresh gale and squally, sea getting up; midnight, strong gales and squally with rain.

Oct. 5th, begins strong gales from S. S. E. and heavy squalls with a high sea; 4 A. M. the same; 8 A. M. gale increasing, ship laboring and shipping much water over all, reefed the fore and aft-sails; 10 A. M. hard gale and heavy sea, with thick hazy weather. [First Cuba gale.] Noon, wind and weather the same; lat. 45° 58′, lon. 55° 30′. Distance 168 miles. P. M. strong gales from S. S. W., and squally weather with a heavy beam sea and constant rain; 4 P. M. more moderate, set the topsail and shook out reefs; 6 P. M. wind increasing again, in first reef of topsail; 10.30 P. M. out reefs and set foresail; more moderate, and clear. [Remission, and approaching westerly change of the first Cuba gale.]

Oct. 6th, wind S. W. moderate, and clear weather, with a heavy beam sea; 7 A. M. wind W. S. W., set topmast and lower studding-sails; 8 A. M. light breeze and fine clear weather *with a heavy beam sea;* noon, lat. 46° 44′, lon. 51° 3′. Distance 198 miles. Cape Race, N. F., bearing W. ½ S. 78 miles; P. M. moderate breeze from W. S. W. and clear weather; 4 P. M. increasing breeze and hazy weather; 8 P. M. blowing strong breeze; midnight, wind W., more moderate. [Rear side of first gale not strongly developed, as a surface wind.]

Oct. 7th, moderate and hazy, wind W., inclining to N. W.; 2 A. M. wind W. N. W.; 8 A. M. wind N. N. W.; 9 A. M. breeze increasing, cloudy; 10 A. M. wind N.; noon, fresh breeze and cloudy, lat. 48° 5′, lon. 45° 41′. Distance 233 miles. [330 miles R. of supposed axis line.] P. M. moderate breeze and cloudy weather, *with a heavy N. E. swell;* 2 P. M. wind N. N. W.; 5 P. M. passed packet ship *Independence*, standing S. W.; 7 A. M. light variable winds and rain; in all fore and aft-sails; midnight, light breeze and dark rainy weather. [This N. E. swell shows the strength of the gale to have been on the *left* of the axis, in a higher latitude.]

Oct. 8th, light breeze from E., *dark and rainy with a heqvy N. E. swell;* [second Cuba storm;] 4 A. M. same; 7 A. M. increasing breeze from E. by S., down top gt. yard and mast and fore-yard; 11, set the fore and aft-sails; noon, moderate and cloudy; lat. 48° 43′, lon. 40° 28′. Distance 213 miles. [350 miles R. of supposed axis line.] 1 P. M. wind E. by S., cloudy, with a *heavy N. E. swell;* 8 P. M. light wind and clear; ends the same. [The easterly winds of second storm had taken effect but moderately this day.]

Oct. 9th, light winds from S. S. E. with a *heavy N. E. swell;* 8 A. M. light airs from S. W.; noon, light winds and cloudy; lat. 49° 14′, lon. 35° 6′. Distance 212 miles. [448 miles R. of supposed axis line.] P. M. light breeze from S. W. and clear weather, with a *heavy N. E. swell;* 6 P. M. wind S. S. E.; 8 P. M. light wind and rain; 9 P. M. wind S. W.; 10 P. M. wind shifted to N. W.; ends moderate and clear. [Easterly part of gale lightly felt, and westerly part but just commenced.]

Oct. 10th, moderate breeze from N. W. and clear; 6 A. M. increasing breeze and cloudy, with *a very heavy cross swell;* noon, lat. 49° 46′, lon. 29°. Distance 237 miles. P. M. fresh breeze from N. W. and fine clear weather; 8 P. M. wind dying away; midnight, light breeze and dark cloudy weather. [Apparent end of the observations on the second Cuba gale; unless viewed as a remission, with a renewal on the 11th.]

Oct. 11th, light winds from S. W. and cloudy, with heavy showers of rain; 4 A. M. increasing breeze and a heavy sea; 7, in first reef of fore-topsail; 8, strong gales and cloudy, close-reefed fore-topsail, and furled fore and aft-sails; noon, strong gales and a heavy cross sea; lat. 50° 26′, lon. 22° 50′. Distance 240 miles. P. M. strong gales and dark weather with frequent showers of rain and a cross sea, sent down top gt. mast; 5, set reefed foresail; 8 P. M. more moderate, with heavy rain; 10 P. M. wind hauling forward, in foresail, dark and threatening weather. [A third storm approaching, probably from the lower latitudes of the Atlantic.]

Oct. 12th, begins moderate breeze from S. by W., and dark cloudy weather; 8 A. M. the same; noon, light breeze and cloudy; lat. 50° 46′, lon. 17° 20′. Distance 225 miles. At 1 P. M. a heavy squall from N. W. which ended in a strong gale; 2 P. M. set close-reefed fore-topsail; 4 P. M. strong gales and squally; 6 P. M. in second reef of foresail; 8 P. M. dark weather, heavy sea running; midnight, same, with a very heavy sea.

Oct. 13th, strong gales from W. N. W. and squally, with a high sea; 3 A. M. wind W.; 8 A. M. wind W. N. W., more moderate; 9 A. M. strong breeze and cloudy; noon, the same; lat. 51° 6′, lon. 11° 5′. Distance 260 miles. Cape Clear bearing E. by N. 63 miles. P. M. wind W., squally, with rain and a high sea; 6 P. M. wind S. W. [*End of Log.*]

We may notice in the log of the *Britannia,* that the length of the observed intervals between the several storm-winds, as well as the duration of these winds, was greatly prolonged by the rapid progress of the vessel in a northeasterly direction. Thus, the change of the first gale to the western board was not observed till past noon of Oct. 5th; although it took place at Halifax previous to 4 A. M. The westerly winds of this gale did not cease with the steamer till P. M. of the 7th; while they had ended at Halifax in the evening of the 6th. The easterly winds of the second gale set in, near Cape Canso, early on the 7th, but did not *overtake* the steamer till near 24 hours later and were but lightly exhibited; while the heavy swell from N. E. seems connected with the more active portion of the gale, which was in a more northerly and advanced position. The *westerly* winds of the second storm, which took effect off Halifax in the afternoon of the 7th, appear not to have reached the steamer till late on the 9th, in lon. 32° W. and then with greatly diminished force. The steamer kept company, for a long time, with the "beam sea" from S. S. E., of the first gale; and, subsequently, with the "N. E. swell" from the active and more advanced portion of the second storm:—showing the progression of these great disturbances to have been in different directions from that of the waves themselves.

It is much to be regretted that no entries of the state of the barometer are found in the Britannia's log, although a column had been provided for this purpose in the logbook.

The northwesterly wind of the second Cuba gale seems finally to have left the Britannia on the 10th or 11th of October. What had then become of this storm and its predecessor does not clearly appear; but it is probable that they were continued, in some unknown condition, in the region lying between Iceland and the European continent.

We may notice that the first of these Cuba storms, which from Florida to New York could scarcely be traced, except barometrically, has appeared the most active of the two after it passed beyond Newfoundland. These latter observations, however, appear to have been made in positions which were much exterior to the most active portions of the two gales; which could not have coincided with each other in their axis-routes, through any known portion of their progression.

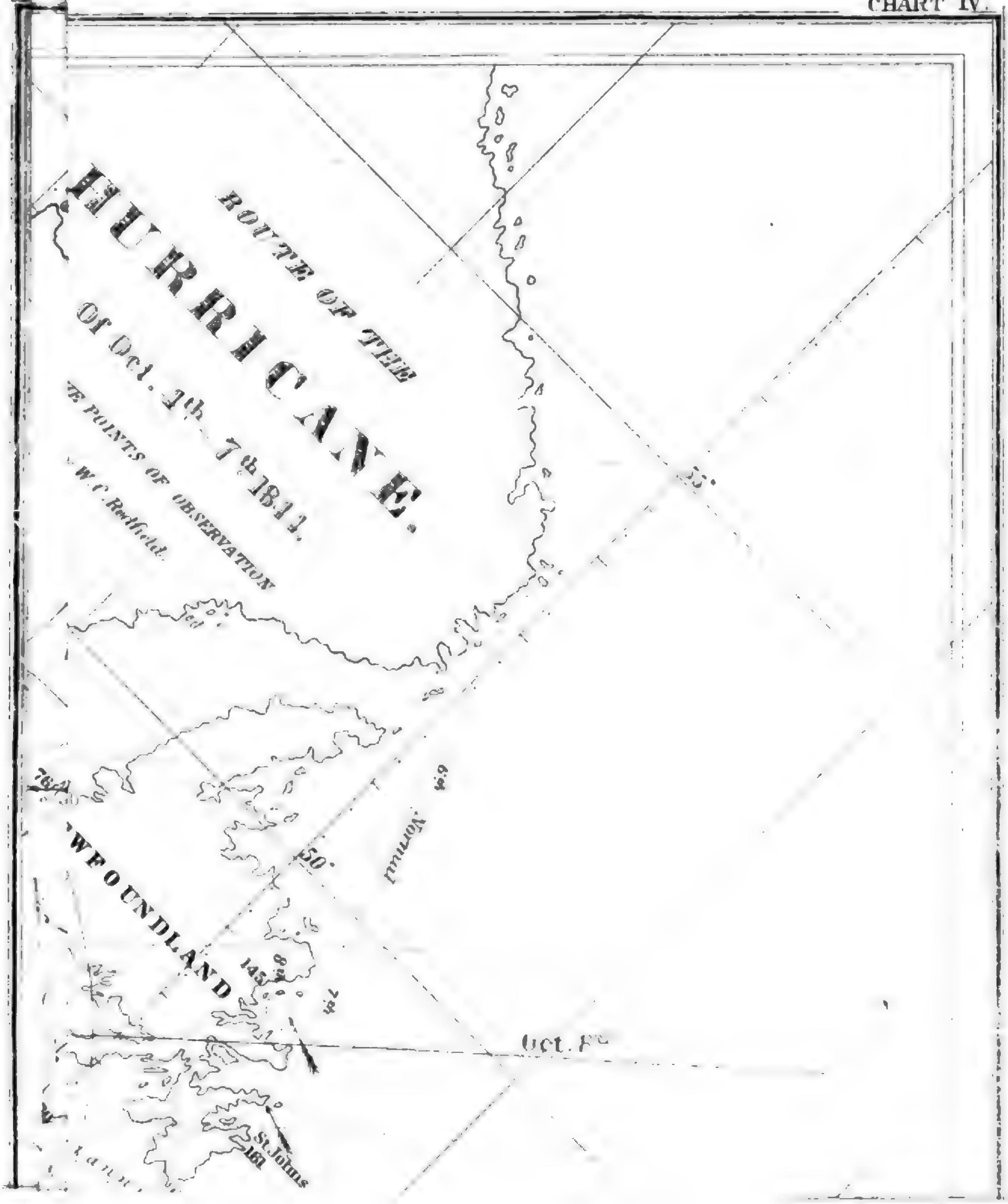
On the 11th or 12th of October the steamer took another storm, which we do not recognize as of American origin; which, at 1 P. M. on the 12th, changed to N. W. and blew a strong gale, and accompanied the steamer on the 13th, to the coast of Ireland.

Gales of the European Seas at this period.

So far as relates to the more immediate objects of this inquiry, the foregoing recitals may suffice. But the relations of the American storms to those of the European seas and coasts are of much importance in meteorology; and we may take, therefore, a hasty glance at the phenomena exhibited by the storms of this period, on the eastern borders of the North Atlantic; as consecutive with the foregoing recitals.

At Lerwick, Shetland, near lat. 60° N., lon. 1° 30′ W., "a heavy gale of wind commenced at South at 5 A. M. Oct. 8th, and veered on the morning of the 11th to E. S. E." "At 7 A. M. of the 10th, during a heavy gale from E. S. E., the *Jesmond*, from Archangel for Hull, drove ashore near Lerwick."—*Shipping Reports.* May not this storm have been identical with one, if not both of the Cuba gales? For we have seen that both these gales were comprised in one extensive barometric depression. For my own part, I am somewhat inclined to this opinion; which may be verified, perhaps, by observations from Iceland or the Ferro Islands, and by logbooks of ships then in the northern portions of the Atlantic. "The *Jane Pope*, from Dundee for Riga, on the 10th October, in lat. 57° 50′ N., lon. 1° 30′ E., experienced a tremendous gale from S. by E., and shipped a heavy sea, which swept five of the crew off the decks." This was doubtless the same gale that visited Shetland.

Oporto, [lat. 41° 11′, lon. 8° 38′ W.] Oct. 14th. "It blew very fresh here on the 9th. The *Ostsee*, from Lisbon, was driven


ROUTE OF THE
HURRICANE.
Of Oct. 4th 7th 1844.
E POINTS OF OBSERVATION
W. C. Redfield.
WFOUNDLAND
55°
50°
Normal
49.9
76.4
145
49.8
49.7
Oct. 8th
St. Johns
161

on shore six miles southward of the bar." Two other vessels were also wrecked at Oporto. At the Scilly Islands, entrance of the English channel, "it blew a terrific hurricane" on the 9th. Foway, (Cornwall,) Oct. 12th: The *Julia*, from Venice for London, experienced a dreadful gale on the 9th inst. at W. N. W.—This storm was generally heavy on the coasts of England and Ireland, and had increased to a hurricane from southeast, at Dublin, on the afternoon and night of the 9th. Several vessels were driven on shore by the gale, at the same period, on the east coast of England. At Elsineur, entrance of the Baltic, (lat 56° 2′, lon. 12° 37′ E.) on the 10th and 11th October, a strong gale from S. E.: the wind had been S. E. on the 9th. This was probably the same as the above gale of the 9th. On the coast of Cornwall it was also blowing a gale from S. S. W. on the 12th and 13th; apparently, another storm.

In the interior portions of England, the storms of this period do not appear to have attracted notice. The register of Mr. Rogerson, of the Royal Observatory at Greenwich, shows that the barometer attained a maximum of 30·37 Sept. 30th; and, after strong S. W. winds a second maximum of 30·01 on the morning of Oct. 4th, which last could hardly have coincided with the advancing front of the great American wave, the summit of which was then not greatly advanced from Newfoundland.* On the 5th, 6th, and 7th, the winds were S. W. and thence to N. W.; on the 8th, S. E. and S. W., and on the 9th *the barometer had fallen to* 29·23 *at* 9 A. M., and 29·17 *at* 3 P. M., with the winds strong at S.; and the bar. was but little higher on the 10th, with the wind at S. and S. W. Perhaps this depression may have been identical with the first Cuba gale, as it doubtless was with that of Shetland.

Col. Reid has favored me with a valuable account of the gale of Oct. 9th and following days, as found in the log of H. M. S. *Windsor*, bound outward from the English channel; of which the subjoined is an abstract.

Oct. 7th, A. M. wind N. N. W. moderate; noon, lat. 49° 47′, lon. 4° 23′ W. *bar.* 30 in.; P. M. wind S. S. W., increasing. Oct. 8th, noon, lat. 49° 20′, lon. 7°, *bar.* 29·50; the whole 24 hours very unsettled weather and barometer falling; wind S. W., unsteady, and increasing. Oct. 9th, wind had veered to N. N. W., coming in hard gusts with sudden intermissions *and barometer had fallen to* 28·60; sent down small spars, double-reefed, &c.; at 8 A. M. *bar.* 28·50, and weather clearing up to the eastward; thought of making sail notwithstanding the low state of the barometer. Saw a schooner close to us with a good spread of canvass. But the wind suddenly flew out from N. E. and back to E. S. E., then E., and we observed the water blown up like clouds of dust and the sea in frightful commotion. This took place at 1·30 P. M.; the *barometer* having been 28·44 at noon, 28·35 at 0·30 P. M., and lowest at 1 P. M. 28·12. It was now (1·30 P. M.) at 28·14, and before the canvass could be got in, the hurricane had struck the ship from the northward with extreme violence, driving her *forecastle under*; at 2 P. M. *bar.* 28·40; at 3 P. M. with great difficulty brought the ship to, on starboard tack; 3 P. M. *bar.* 28·60; at 5 P. M. hurricane less violent, and settled into a heavy gale, veering to N. W. and W. N. W.; at 8 P. M. severe gale, with sleet, hail, rain and vivid lightning; at midnight, *bar.* 28·99; gale blowing with unabated violence.—The schooner which was close to us disappeared suddenly, and there is little doubt that she foundered. Oct. 10th, heavy gale from N. N. W. with a high sea; noon, lat. 48° 51′, lon. 8° 4′ W., *bar.* 29·40; midnight, no alteration.

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* See bar. obs. at St. Johns, and on board the *Prince Albert*, lon. 38° 30′.

The steamer *Britannia*, at noon of the 10th, was 927 English miles W. by N. of the *Windsor*, and was then running in the N. W. wind or rearward portion of the *second* Cuba storm. This is not incompatible with the idea that these storms may all have pertained to the general area of a great barometrical depression, though divisible, at the earth's surface, into two or three stormy vortices, which may have continued more or less distinct from each other, in successive localities.

It appears, also, that the *Severn* for Liverpool, Oct. 13th, in lat. 48° 49′, lon. 16° 4′ W., encountered "a perfect hurricane," with a tremendous sea. Likewise, the barque *Providence*, Oct. 13th, lat. 49°, lon. 13°, had a severe gale, lost spars, &c. This was the gale which the *Britannia* experienced, less severely, near the coast of Ireland.

From the courses which we have seen pursued by the two associated storms in the Western Atlantic, I have supposed their further progress to have been on lines somewhat curvilinear, towards Iceland or that part of the Atlantic which lies between Iceland and the British islands. Their direct identity or immediate connexion with the European storms already noticed, may be considered as doubtful. If we suppose the Cuba storms to have acquired, gradually, a southeastern progression in higher latitudes, before reaching the British islands, the difficulties of allowing a partial identity might be lessened; and, possibly, the wave-like propagation of the barometric oscillations, from different parts of the line of progress, may have induced some of the complications of the barometric waves which serve to embarrass the inquiry:—complications which are not uncommon in northern Europe. Such southeastern progression might serve to explain the veering of the wind *from the southern or southwestern quarter to the northeastern*, which appears in some of the above European reports, and was also found in the *extremely* violent hurricane of Dec. 12th, 1844, in the Eastern Atlantic, in which two of the New York packet ships were lost by foundering; a fact unexampled in the history of our navigation. But such southeastern course in a great storm of the northern hemisphere, so far as I know, has not yet been established.

It has been shown by MILNE and others that several of the British storms have pursued a northeasterly course, in their progress from lower latitudes, and that their rotative action was from right to left, ↺, as in the North American gales. In order to obtain a more definite and correct estimate of the progression and extended relations of the European storms above noticed, it would be proper to examine observations made at Madeira and the Azores, in connexion with such other geographical data as might be obtained by patient inquiry.*

We next proceed to a review of the phenomena of the Cuba hurricane and its prelusive storm, while in progress from the shores of Central America to the Gulf of St. Lawrence and Newfoundland.

ART. III.—*Description of a new Fossil Fish, from the Palæozoic Rocks of Indiana;* by J. G. NORWOOD, M. D., and D. D. OWEN, M. D.

WITHIN a few months a very interesting discovery of a fossil fish has been made fifteen miles N. W. of Madison, Jefferson county, Indiana, in the rock forming the bed of Lewis's creek, a branch of the Muskatatac river.

Unfortunately, before the specimen came under our inspection, it had suffered greatly from thoughtless mutilation, while in the hands of the quarryman, which renders it difficult to give a satisfactory description of this remarkable fossil.

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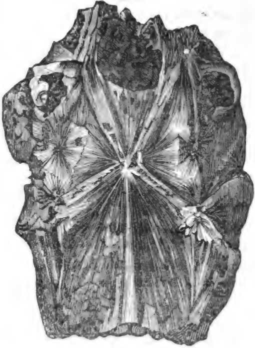
* T. C. HUNT, Esq., the British Consul at the Azores, has been indefatigable in his endeavors to secure good observations at these islands and Madeira; where the meteorological phenomena may sometimes have important relations to those of the coasts of western Europe, or other parts of the Atlantic basin. I am indebted to Col. REID and to Consul General HUNT for valuable records and communications on the meteorology of those islands, of an earlier date than the storms now under consideration.

Fig. 1.

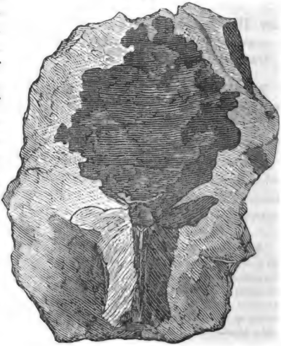


The accompanying figure, (No. 1,) gives a view of the upper surface of the fossil in its present condition. No. 2 represents the under surface, but the figure is not as perfect as the one of the upper surface.

In length it measures ten inches; in width, following its greatest convexity, nine and one fourth inches; its average thickness is about one and one fourth inches. It is evident that the fossil is a ganoid fish, analogous to those described from the Devonian System of Europe. The head and anterior part of the body are covered with large angular osseous plates or scutcheons; they differ, however, in number, form and position, from those of any of the European fossil fishes we have seen figured.

Eight plates only are visible. Their

Fig. 2.



outline and relative position are distinctly shown in figure 1; so, also, are the radiating lines of ossification. They present no appearance of tuberculation, unless the slight elevations which form the centres from which these radiations proceed, can be so considered.

The anterior plate is oval-lanceolate, and was evidently prolonged into a snout, not unlike that of some species of Chondropterygii.

From the central lateral scutcheon plates project two marked prominences, which seem to have been the articulating surfaces of two spinous lateral appendages, perhaps somewhat similar to those of the *Pterichthys cornutus*, described by Hugh Miller.* What renders this supposition still more probable, is, the quarryman affirms, that before it was mutilated, it had "two great horns" projecting from that part of its head.

The scutcheons were evidently covered with angular, irregularly rhomboidal, and highly enamelled, but minute scales, for many of them are well preserved, especially on the left posterior scutcheon. With a magnifying glass the enamel of some of them appears to be even translucent.

No eyes are distinguishable on the part from which the drawing was taken; but, on the mould from which the specimen was removed, and which we fortunately discovered during a recent visit to the locality, a smooth, convex surface can be seen on both sides, anterior to the position of the spinous appendages, which may, possibly, be remains of eyes; but the structure is not sufficiently distinct to enable one to form a decided opinion.

The end view of the posterior portion of the fossil exhibits in the median line, three tenths of an inch beneath the upper convex surface of the body, a beautifully distinct condyloid articulating surface, composed of two ovoid, smooth prominences, separated by a slight groove; where, probably, was attached either the posterior portion of the body or the tail.

The under surface is irregularly concave, presenting a polished aspect towards the anterior and central part where the fossil is uninjured, and is partially incrusted with a thin, dark, smooth, glossy, lamellar substance, but without any radiations or sutures indicative of plates.

The lateral posterior parts are rough and irregular, presenting merely the fracture of the rock. But, situated between these

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* "New Walks in an Old Field."

rough, irregular surfaces, in the median line, and occupying the posterior portion of the fossil, are two smooth, divergent planes, slightly convex anteriorly, and turning forwards and outwards, forming, together, an arch two and a half inches long, one and nine tenths of an inch wide at their outer and most divergent edges, and seven tenths of an inch deep. These surfaces do not meet precisely at the top of the arch, but are separated by a small and slightly elevated angular groove, divergent anteriorly and posteriorly, in which latter direction it seems to terminate in two slightly convex articulating surfaces, sloping off, posteriorly, into a smooth concave depression, forming the segment of an arch, which is separated by a bow-shaped and rather sharp ridge from the before mentioned ovoid condyloid surfaces.

This arch formed, perhaps, the pharyngeal walls, while the angular groove in its vertex, which was a closed canal before the fracture of the fossil, served for the lodgment of medullary matter.

Geological position.—With a view to ascertain the exact stratigraphical place of this specimen, we visited the quarry a few weeks since, and were fortunate enough to discover the rock containing the mould of the fossil in question, so that its exact geological position has been most satisfactorily ascertained. This interesting relic was split out of a subcrystalline layer of light grey limestone, containing numerous *Atrypa prisca* and *Spirifer euruteines* (perhaps a small variety of *Delthyris congesta*); associated with *Strophomena euglypha*, *Pterinea cardiiformis*, *Favosites spongites*. *Pileopsis tubifer?* *Calymene bufo*, *Tentaculites scalaris*, *Cardium alæformis*, *Calymene crassimarginata*, *Astrea flexuosa?* and other fossils characteristic of the shell beds which form part of the chain of rocks in the bed of the Ohio river at the falls, immediately under the water limestone found in digging the Louisville canal. On Lewis's creek, however, the water lime is absent, or represented only by a thin layer of chert, and the black slate is found in the bank of the creek, not four feet above the layer containing our fossil fish. This black slate is most likely the equivalent of the Genesee slate, and not of the Marcellus shale of the New York survey, since the underlying layers, though they contain several Onondaga and corniferous fossils, yield, also, many organic remains of the Hamilton group.

If this fossil fish should prove to be a new genus, as would seem to be indicated, not only by the great size of the scutcheon plates, but also from their peculiar form, together with the posterior position of the arch-like structure on the inferior surface, we propose for it the name *Macropetalicthys rapheidolabis*, in allusion to the great size of the scutcheon plates, and the pincer-like form produced by the union of their sutures.

This is so far as we know, not only the first instance of finding scutcheoned fishes in this country, but, also, the lowest position in which remains of Vertebrata have been found, if we except defensive fin bones, which occur in New York nearly in the same geological position, viz. in the corniferous group, and the scales of fishes which the Professors Rogers traced throughout the Clinton group of Pennsylvania and Virginia.

Madison, Ia., Feb. 16, 1846.

Note by D. D. Owen.—Some of the members of the Academy of Sciences in Cincinnati, supposing it to be a *Pterichthys*, suggested the name *P. Norwoodensis* out of compliment to Dr. Norwood, who secured the specimen and first called the attention of men of science in the West to it. Dr. N. as well as myself, objects to this principle of nomenclature superseding the descriptive one; it is for this reason alone that I have consented to this decision.

Art. IV.—*Coal Field of Tuscaloosa, Alabama,*—being an extract of a letter to Prof. Silliman, from Charles Lyell, Esq., dated Mobile, Alabama, Feb. 19th, 1846.

Since I wrote to you last, I have been engaged in the study of the carboniferous rocks and coal of Alabama, respecting the existence and extent of which, I was unable to obtain any accurate information, when I compiled the small geological map of the United States that accompanied my Travels. Mr. Conrad had mentioned to me the existence of a bed of coal, the geological age of which he had not ascertained, above Tuscaloosa, and I learnt from several persons on my way south, as I passed through Georgia, that the city of Mobile was supplied with bituminous coal, for fuel and gas, brought down the Tombecbee River, by a navigation of more than 350 miles. When I heard that it was procured not far from the northern outcrop of the newer formations, whether cretaceous or tertiary, that it occurred very near the falls of the Warrior River, the principal tributary of the Tombecbee, and that it was used for the manufacture of gas at Mobile, I suspected that it might be related to the Richmond coal, which is bituminous, situated near the falls of the James River, and placed nearer the Atlantic than the coal of the Allegheny range, than which it has also been shown to be newer in date, by Prof. W. B. Rogers.

In order to determine, if possible, its chronological relations, and obtain information respecting its extent, I ascended the Tombecbee, from Mobile to Tuscaloosa, where, at the University, I found Prof. Brumby, who had examined with considerable care the geographical boundaries of the productive coal measures, and the structure of the region. With him, I made an excursion to some of the pits, or rather open quarries of coal, where the edges of the beds of several seams have been dug into by different individuals, entirely ignorant of mining operations, but with no small success, the quality being good at the points of natural outcrop. I found the coal seams every where covered with beds of ordinary black carbonaceous shale, full of impressions of more than one species of Calamite, with ferns of the genera Pecopteris and Neuropteris, and impressions of Sigillaria and Lepidodendron. In some of the beds, Stigmaria has also been met with not unfrequently. I recognize a specific identity between several of the most common of these coal plants and those of Europe, Ohio, and Pennsylvania, and I observe that they are completely different from the vegetable remains that are most abundant and characteristic in the newer or Virginian coal field, near Richmond, which I had lately an opportunity of examining on my way South. The strike also of the coal beds of Alabama, on the Warrior River, where I saw them, and those of a coal field immediately to the east, examined by Prof. Brumby, is northeast and southwest, agreeing with the general direction of the Allegheny Mountains, of which, geologically speaking, they are evidently a southern prolongation. They are in fact portions of the great Apalachian coal field, exhibiting all the same mineral and palæontological characters, the beds having been bent into anticlinal and synclinal ridges, similar to those of the Alleghenies, with corresponding dips to northwest and southeast.

Alabama is the first state, as we proceed from the northeast, where we can pass from the Atlantic plain, occupied by tertiary and cretaceous strata, to the older rocks of the Apalachian region, without first crossing an intervening zone of the hypogene or granitic rocks. In the eastern part of the State, the crystalline formations still appear, as at Wetumpka, where, as I learn from Prof. Brumby, the lower cretaceous rocks rest upon mica schist. But on going westward to the Cahawba River, and still farther west to the Warrior, at Tuscaloosa, we find the carboniferous strata concealing the granitic rocks, or coming into direct contact with the cretaceous. At the falls of the Warrior, at Tuscaloosa, beds of gravel containing well rounded pebbles of quartz, are seen to rest unconformably on the gray micaceous sandstone of the coal, which is full of Calamites and impressions of Lepidodendron and Sigillaria. I should have felt very doubtful respecting the true age of the overlying unconsolidated gravel and sand, in which no organic remains have yet been discovered, in that neighborhood, if I had not carefully examined the position of similar beds of loose gravel 30 feet thick, at Montgomery, 100 miles southeast, on the Alabama River, as also at spots between Montgomery and Wetumpka. In nodules of an impure limestone, in a loam overlying that gravel, and almost in contact, I found casts of Inoceramus, Rostellaria arenarum, and other common chalk fossils. They are well seen at the bluff, in the suburbs of Montgomery, and there are beds of gravel, and various colored sands and clays below them; the general dip of the cretaceous strata being to the south, which brings up the edges of certain calcareous marls, newer than the gravel, but of the same epoch, producing prairie soils, often destitute of natural wood, which run for a great distance east and west, or in the line of their strike, crossing the Alabama several miles south of Montgomery, and being again seen in their western prolongation on the Tombecbee, at Arcola and other places. It is due to Mr. Conrad, to state that in an outline map which he presented to me in 1842, with permission to publish any part of it in my general map, he had traced out the course of the lower cretaceous beds, especially their northern boundary in Alabama, with great approach to accuracy, from observations made by him, and information obtained during his tour in 1833.

The members of the carboniferous series, which I examined in an excursion with Prof. Brumby, within a distance of between

30 to 40 miles northeast of Tuscaloosa, may be said to consist of three subdivisions: 1st, the productive coal measures; 2d, quartzose grit, used for millstones, with schistose sandstones and slates; 3d, limestone and chert. The first of these, or the productive coal measures, consist of the usual white sandstones and grits, so common in all coal fields, with greenish and gray micaceous sandstones, and some ripple-marked slabs of yellow sandstone, with Calamites. Associated with these, are shales and clays, with seams of coal, the thickest of those which I saw being about four feet, but a ten foot seam has been discovered sixty miles farther to the north. I saw a thickness of many hundred feet of this formation, but have no data for estimating its entire vertical extent. To the above succeeds, in the descending order, a great deposit of quartzose grit, used for millstones, which resembles in position and mineral character, the millstone grit of the north of England, and perhaps occupies the place of the fundamental conglomerate of the great Apalachian coal field. It passes downward into thinly laminated sandstones, and dark slates of small thickness. Under this group lies a formation of limestone, usually blue, with white veins of carbonate of lime, and with much chert and hornstone intermixed. In the pure limestone, which is fetid, when broken, no fossils have been found, but in some of the associated siliceous beds, Prof. Brumby has obtained Encrinites, Producta, Orthis, and one or two corals, which have not yet been determined, but the genera which I saw, are such as might belong to the carboniferous limestone. In some of the inferior beds of limestone, there is a great mixture of iron, and throughout the range of this formation, there has been traced an enormous mass of brown hematite, which seemed to me to constitute, where I examined it at Murphy's, 30 miles from Tuscaloosa, a regular bed, rather than a vein. From the abundance, accessibility and richness of this ore, its proximity to the coal field and to the navigation of the Tombecbee River, I can hardly doubt that, like the coal itself, it is destined, at no distant day, to be a source of great mineral wealth to Alabama. I may also mention that large specimens of pure galena, obtained from this limestone formation, have been shown me by Prof. Brumby, who found them in the counties of Tuscaloosa, Bibb, Shelby, Jefferson, and Blount, as also in the Tennessee valley, in Alabama;

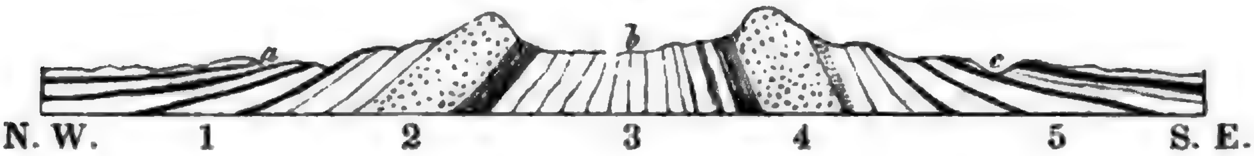
but no search has yet been made by miners to ascertain whether the lead could be worked to advantage.

It would have been impossible for me, during my short visit to this region, to form more than a conjectural opinion respecting its structure, still less could I have determined the geographical area of the Alabama coal fields, had not these subjects been previously studied, with great care and scientific ability, by Prof. Brumby. Of the extent of the coal, he published a brief account in Barnard's Almanac for 1838, and communicated the same to Dr. Silliman. It appears that south of the waters flowing to the Tennessee, there are two parallel coal fields—those of the Warrior and Cahawba rivers. The western of the two, that of the Warrior, has a length of more than 90 miles from northeast to southwest, and a breadth of from 10 to 30 miles. It extends through the counties of Tuscaloosa, Walker, Jefferson and Blount, on both sides of the Warrior River, and its several branches. Throughout all this area, seams of bituminous coal crop out, the number and thickness of which it has been impossible as yet to determine, as no regular survey has been commenced of this State. That there must, however, be many distinct seams, is evident, as I saw several different ones between 11 and 20 miles of Tuscaloosa, which had been worked with profit, and considerably farther to the northeast, three have been seen superimposed upon each other, the largest and lowest appearing in the bed of the Warrior River, and being no less than 10 feet thick.

The more eastern coal field, or that of the Cahawba, is nearly of equal length and breadth, terminating southwards at Centreville, where it meets the lower cretaceous beds, and extending from thence through Bibb, Shelby, Jefferson and St. Clair counties, to the sources of the Cahawba River. In this, also, numerous beds of coal of good quality have been detected, and some of them worked to a small extent.

From what I saw of the structure of the country between Tuscaloosa and Rook's valley, and from the facts communicated to me by Prof. Brumby, I have no doubt that a section passing from northwest to southeast, from the coal district of the Cahawba to that of the Warrior River, would present an additional axis along the line of the water-shed between the two rivers, where the beds are highly inclined, and occasionally vertical, and the productive coal measures occur on both sides, their strata having a slight dip, and being in some places nearly horizontal. These views will best be explained by the annexed diagram.

Coal Fields of Alabama.



References.—*a*, Warrior river; *b*, Rook's and Jones' valley; *c*, Cahawba river. 1, Coal measures; 2, Grit; 3, Limestone and Chert; 4, Grit; 5, Coal measures. Length of section, 50 miles.

On the northern confines of the State of Alabama, there is a third coal field, that of the Tennessee valley, which is separated from the two former by a broad but low chain of mountains, which run nearly east and west, and intervene between the Tennessee and the sources of the Warrior and Cahawba rivers. These mountains, according to Prof. Brumby, consist of strata, like those before described as occurring immediately below the productive coal measures between the Warrior and Cahawba rivers, and consisting chiefly of quartzose grit and limestone. I could not ascertain whether this coal of northern Alabama, which runs about 100 miles east and west, along the Tennessee River, is actually continuous with the southeastern coal measures of the Apalachians, in the State of Tennessee, but it seems highly probable that they are united.

A careful comparison of the fossil plants of the Alabama coal field, which I have collected myself, or which have been liberally presented to me by Prof. Brumby, with those of the more northern coal fields, and of Europe, will be a subject of peculiar interest, as they are situated in lat. 33° 10′ north, and constitute, if I mistake not, the extreme southern limit to which the peculiar vegetation of the ancient carboniferous era has yet been traced, (in the northern hemisphere,) whether on the western or eastern side of the Atlantic.

Art. V.—*An attempt to refute the Reasoning of* Liebig *in favor of the Salt Radical Theory;* by Robert Hare, M. D., Prof. of Chemistry in the University of Pennsylvania.

Messrs. Editors—Agreeably to the notice given at the close of my last communication in this Journal, p. 82, I will proceed with my objections to Liebig's reasoning in support of the salt radical theory, commencing with another quotation from his lectures delivered at Geissen,* for that purpose.†

16. "*In one atom,*" *says the lecturer,* "*of a metallic oxide containing one equivalent of oxygen, this oxygen is replaced by one equivalent of chlorine, when brought into contact with an hydrogen acid. Take a metallic oxide containing two equivalents of oxygen, bring it into contact with an hydrogen acid, such as hydrochloric acid, what will be the chlorine compound produced? A corresponding metallic chloride. Take an oxide of the third class,* (*two atoms of metal, three atoms of oxygen,*) *what will be the product? A compound in which you will find two atoms of metal combined with three atoms of chlorine.*

M, O, M, Cl
M, O^2, M, Cl^2
M^2, O^3, M^2, Cl^3."

17. The facts mentioned in the preceding quotation, being represented by Liebig as justifying in inference that the proportions in which chlorine and metals combine, is due to the oxygen and hydrogen with which they may happen to be in combination, he proceeds thus to proclaim his impressions. "*Upon what, then, does the saturating capacity of the acid depend? Upon the hydrogen it contains. Upon what does the property of the base* (*of the metallic oxide*) *of neutralizing the acid depend? Upon the oxygen it contains.*" Thus the property of the halogen bodies, of forming neutral haloid compounds with metals, is not the consequence of the affinity for metals which they exert, when naked, but rests upon the fact that they *may have been, are now, or may hereafter be, severally in union with oxygen and hydrogen;* so

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* The Lancet, (London,) Vol. II, No. 1090.

† Dr. Hare's second communication having been too late for insertion in the number for March, the whole is given in this number—that is to say, both the second and the conclusion.—*Eds. Am. Jour.*

that a mere liability to combine with these elements, endows them with a power to combine with other elements, of which power they otherwise would have been destitute. Liebig ascribes to hydrogen, not only the "*action of presence*," but an "*action of absence*" likewise. According to him, the halogen bodies owe their power of entering into union with metals, to the hydrogen which they contain, not only *when the element is present*, but to their susceptibility of uniting with it, whether *retrospectively* or *prospectively*. Let us see whether the phenomena on which these startling conclusions rest, are not susceptible of a more rational explanation.

18. When any radical unites in several equivalent proportions with any one electro-negative body, it will usually unite in the same proportions with other electro-negative bodies. This is in a great measure exemplified in the case of the oxides, sulphides and chlorides of iron; the oxides, sulphides and chlorides of tin and antimony. In like manner, the proportions in which oxygen enters into union with phosphorus and with arsenic are the same: also for every oxide of mercury we have a corresponding sulphide and chloride. But in some instances we have oxides of which there are no corresponding chlorides with the same radical. Thus in the instances of the metals potassium, sodium, calcium, barium and strontium, we may have peroxides but not perchlorides. Whenever the metal can form a perchloride, its peroxide, on due contact with the chloride of hydrogen, (muriatic acid,) is resolved into water and a perchloride. But when the metal is incapable of forming a perchloride like those above mentioned, peroxides are not convertible into perchlorides.

19. According to my apprehension, during the reaction of oxides with hydracids, so called, the hydrogen and oxygen only assist, by getting each other out of the way. In most instances, in which a chloride is generated by the meeting of an oxide with the chloride of hydrogen, it may be produced by presenting the metal to gaseous chlorine, *with* heat, if not *without*.

20. With respect to the peroxides of the metals of the alkalies and alkaline earths, it has been stated that the law here enunciated does not prevail; and I think it must be evident that the quantity of chlorine in the resulting chloride, is dependent solely on the affinity between chlorine and the metal. The hydrogen may resist this affinity when oxygen does not coöperate, as when

the metal is not oxidized; but even when present, hydrogen cannot be the cause or regulator of the affinity; and to suppose that when absent, it imparts affinity or capacity, strikes me as unreasonable. Was there ever a greater heresy in science, than this idea, that thirty-six parts by weight of chlorine, combine with forty of potassium, not because it is the nature of these elements to unite in these proportions, but because one of them *has been*, is now, or *may hereafter be* united by a much more feeble affinity to one part of hydrogen. With all due deference for the author, the efficiency attributed to hydrogen, by him, appears to me as unjustifiable as it is anomalous.

21. But is it with the chloride of hydrogen only that the binoxide of mercury will yield a bichloride? May not this last mentioned compound, the well known corrosive sublimate, be obtained by sublimation of the sulphate or nitrate of the binoxide of mercury with various chlorides?

22. It is assumed, by Liebig, in his lecture above mentioned, to be a general law, that the number of equivalents of acid requisite to saturate a base, is equal to the number of atoms of oxygen which it may contain. His words are: "one equivalent of oxygen in a base requires one equivalent of acid, two require two, three require three." In the next paragraph the fact is cited, that protoxide of potassium will take only one equivalent of acid to saturate it. But if the preceding allegation be true, how does it happen that the peroxide of potassium does not take even one equivalent of acid, unless by being resolved into a protoxide, so that the addition of oxygen, instead of producing the result which flows from this general law, actually has an effect diametrically opposite? The same allegation may be truly made of the peroxides of each of the metals of the alkalies or of the alkaline earths. Yet the protoxides of potassium and sodium ***both unite with two equivalents of sulphuric acid.***

23. In the instances of lead, tin, antimony and manganese, the addition of oxygen beyond a certain amount, destroys the affinity for acids attendant on inferior degrees of oxidation, no less than in the instances above mentioned.

24. Among the evidences adduced by Liebig, as justifying the law above mentioned, is the fact, that in the persulphates of iron and chromium, two atoms of metal, taking three of oxygen to form a sesquioxide, one atom of the sesquioxide requires for

saturation three atoms of acid; but the reason why neither iron nor chromium can form a binoxide, is a mystery which is not represented as explicable agreeably to the new doctrine. As there can be no doubt that there is a common rationale of this fact, and of the analogous necessity of three atoms of acid to saturate two of the resulting sesquioxide, it follows that there is only one mystery to explain agreeably to the old view of the constitution of oxysalts; but this mystery exists just as much in relation to the new view, substituting oxysulphion or some other imaginary compound radical for oxygen. The mystery, in one case, is wherefore two atoms of mercury are capable of taking four atoms of oxygen with four of acid, when two atoms of iron can only take three of oxygen and three of acid. In the other case, the mystery is that two atoms of mercury should take four atoms of oxysulphion, while the same number of atoms of iron take no more than three.

25. In the cases above cited, hydracids in combining are made to abandon hydrogen; yet the oil of the Dutch chemists is represented by Liebig,* as a "*hydrochlorate of the chloride of acetyl,*" in which muriatic acid is made to act as an acid, *in propriâ personâ*, without either losing or gaining hydrogen. In this instance, it would seem that the celebrated author had precisely the same view of an acid which has been heretofore generally entertained, *that it is a body that will combine with a base without decomposition.*

26. Agreeably to the language held by this great chemist respecting his hydracids, it would seem as if the essential character of acidity were an incapability of existence, excepting by being first united with hydrogen, and a susceptibility of being resolved into what Berzelius considers as a haloid salt, by being presented to oxybases. How, then, does it happen that this decomposition does not ensue on the presentation of the chloride of hydrogen to the hydruret of acetyl? How does it arrive that the hydrochloric acid forms chlorides with metals, while in this ethereal compound it forms a veritable hydrochlorate? Is it in the latter, or in the former case, that it has a true acid reaction? According to my apprehension, it is only in the latter that it acts as an acid, but not as a hydracid. It performs, as I infer, the part

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* Liebig's Gregory's Turner, p. 896.

of a chloro-acid, and combining with a chloro-base, the resulting combination may be correctly called the chlorohydrate of the chloride of acetyl.

27. In the next place let attention be given to the inquiries contained in the following language of Liebig.

"*But how, we may ask, are these so-called anhydrous acids known? Can we exhibit them without this water of hydration? The following strange answer is returned to this question by the adherents of this theory:—the innumerable acids which we call anhydrous, exist only in imagination; they are quite unknown; they cannot be shown to you.*"

28. Although agreeably to Liebig's work upon organic chemistry, nature is prolific of compound radicals, which for the most part have never been isolated, although *none* of those whose existence is assumed by the salt radical theory have been isolated, yet agreeably to his language above given, the fact that *some* of the anhydrous oxacids cannot be isolated, is treated as an objection fatal to their existence altogether.

29. The decomposition of chlorate of potash in aqueous solution, by sulphate of the protoxide of iron, is represented as a case in which protoxide of iron overcomes the affinity of potassium for oxygen, treating the paramount affinity of chlorine for that metal as a consideration which could only be insisted on "*for the sake of argument.*"

30. Agreeably to the salt radical theory, in each of the oxysalts, of which the reaction is the subject of the preceding paragraph, there is a salt radical, (oxysulphion in the sulphate, oxychlorion in the chlorate,) yet chloride of potassium is the result of the process, no less than if potash were subjected to muriatic acid. Admitting that in the reaction of this last mentioned acid, the formation of the resulting chloride is due to hydrogen, how comes it that notwithstanding the absence of this *capacity giving* element, we obtain a chloride of potassium? What indication is there of the presence of oxychlorion or oxysulphion?

31. The resolution of sulphate of potash and cyanide of potassium, when fused together, into cyanate of potash and sulphuret of potassium, is by Liebig mentioned as an instance in which "*potassium reduces potash,*" an inference which is erroneous: first, because potassium cannot take oxygen from its own protoxide; secondly, because the affinity of the sulphur for that

metal, the most powerful force engaged in the whole process, is overlooked; and thirdly, because the potash is not reduced, but on the contrary, unites with the cyanic acid formed by the union of the oxygen of the sulphuric acid with cyanogen.

32. Under the circumstances in question, agreeably to the old doctrine, three atoms of oxygen, one of sulphur, one of cyanogen, one of potassium, and one of potash are present. The sulphur seizes the potassium, the oxygen for the most part unites with the cyanogen, forming cyanic acid, which combines with the potash. This is just what ought to take place, consistently with the premises.

33. But according to the new doctrine, the agents being one atom of oxysulphionide of potassium, and one atom of the cyanide of the same metal, the result is precisely such as to justify the impression, that the pre-existence of oxysulphion in the sulphate, and the generation of oxycyanion in the resulting cyanate, are imaginary.

34. It is advanced by Liebig, agreeably to a table which he gives, that there are seven salt radicals, consisting of sulphur variously oxidized; and it is remarkable, that anhydrous sulphuric acid SO^3, is treated as the compound radical of sulphurous acid. Were this correct, anhydrous sulphuric acid ought to produce sulphites on contact with metals in the metallic state.

35. Alluding to the old opinion of the constitution of salts, Liebig inquires: "*upon what does the power of saturating an oxygen acid depend, according to this theory: whence proceeds neutrality? Why is it necessary that for every equivalent of oxygen in the oxide, an additional equivalent of the so-called anhydrous acids must be present?*"

Replying to the latter of these inquiries first, I refer to the facts above adverted to by me, (par. 22,) that in the case of the peroxides of the metals, of the alkalies and alkaline earths, each additional atom of oxygen does not give the power of combining with an additional equivalent of acid. Moreover in the case of the metaphosphates adduced by the author, an oxide in the tribasic phosphate has the power, without any addition of oxygen, to unite with three times as much acid as in the monobasic phosphate.

36. I will also again call attention to the fact, that although neither the peroxide of potassium nor that of sodium, will unite

with even one equivalent of sulphuric acid, either of the protoxides of those metals may combine with two equivalents of that acid, so energetically as to be fusible without decomposition into a dry mass: I allude here especially to the well known bisulphate of potash. I have already animadverted upon the fallacy of assuming that muriatic acid gives a bichloride on meeting with a bioxide, only in consequence of the presence of two atoms of oxygen in the latter, (17, &c.)

37. There does not appear to me to be any more difficulty in assigning a reason for the union of an oxybase with an oxacid, than in accounting for the union of the radicals, entering respectively into their composition, with oxygen.

38. The more any two bodies differ in their electro-chemical habitudes, the greater is their reciprocal affinity. Hence as potassium is strongly electro-positive, while oxygen is strongly electro-negative, they unite with an energetic affinity. But as potassium is more electro-positive than oxygen is electro-negative, in combining with oxygen it produces an electro-positive oxide. On the other hand, oxygen being more electro-negative than sulphur is electro-positive, on combining with it forms oxides which are electro-negative. Hence an affinity prevails between the oxacids of sulphur and the oxybase of potassium, which though less energetic than those existing between oxygen and sulphur, is founded on a similar electro-chemical diversity.

39. "*Do you find*," says Liebig, "*any of the characteristic properties of hydrogen acids in chromic acid, boracic acid, silicic acid, titanic acid, or their combinations with oxides?*"

40. In the interrogation here quoted, the author of a new, vague, and undefined idea of acidity, appeals to that idea in support of a nondescript innovation.* Is it not surprising, that it should not be perceived, that the enquiry would be more justifiable if reversed, and that all claims to the acid character on the part of the hydrurets alluded to, might be denied upon the ground that they are deficient of that all-important property of combining with oxybases, on which the claims of oxacids to the acid character has been considered as dependent? In consequence of the deficiency of this attribute, the quadroxide of nitrogen NO^4, has been treated of by Berzelius, as unworthy of a place in the

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* See this Journal for January, 1486.

class of acids; and in a letter to me this great chemist admitted, that he had been inconsistent in overlooking this deficiency in the case of the hydrogen acids or "hydracids," erroneously so called.

41. That the oxacids enumerated in the words last quoted, should have none of the properties of hydrogen acids after presentation to oxides, is precisely what occurs when hydrogen acids are presented to oxides agreeably to the following allegation of Liebig, "*the hydrogen compounds possess an acid character which is destroyed by the substitution of a metal for hydrogen.*" Thus the oxides are expected to acquire in combination, properties of hydrogen acids, which under circumstances treated as analogous by the author, those acids do not themselves retain, agreeably to his own representations.

42. Liebig enquires, how, consistently with the old doctrine, is it to be explained, "that the amount of oxygen *in a base*, determines its power of neutralization." Having shewn that it does not have this effect in the instance of oxides formed with some of the most energetic metals, (18,) I beg to know how it is that the amount of hydrogen which is not in union with a body, can regulate its susceptibility of neutralization? (20.)

43. Again, "*we want to know*," says Liebig, "*upon what constituent of the acid its capacity of neutralizing the alkaline properties of bases depends.*" In reply to this query, I would ask, what reason is there for supposing, that the property of neutralization is dependent on any constituent in particular? Agreeably to my opinion, this property depends upon an electro-chemical diversity existing between the electro-negative element and the electro-positive radicals, severally of the acid and base. This diversity is not so completely neutralized by the chemical union to which these compounds owe their existence, as not to leave between them an analogous diversity sufficiently powerful to endow them with that difference of relation to the voltaic poles, which is the only true and universal test of what I would call acidity and basidity. It is thus that I would account for the power of oxacids and oxybases to unite so as to produce to a greater or less extent reciprocal neutralization.

44. Agreeably to Liebig, "*salts are combinations of simple or compound radicals with metals, corresponding in composition with the degrees of oxidation of the latter.*" If there be

any known compounds which are preëminently entitled to be designated as salts, would it not seem that chloride of sodium and those of the haloid compounds which are its congeners in properties and composition belong to that class? I have however objected to extending the designation to such haloid compounds as utterly differ from chloride of sodium in properties, however analogous in composition; such for instance, as the fuming liquor of Libavius, the butyraceous chlorides, plumbum corneum, luna cornea, fluoride of calcium, and the gaseous haloid hydrurets, treated as hydracids by Liebig. It has appeared to me that a salt properly means a body having some analogy in properties with common salt, the original type of the genus. I have urged that there were oxides, in this respect, more entitled to be considered as salts than some of the compounds formed by the salt-producing class of Berzelius. But according to the definition above quoted, common salt, chloride of sodium, is a salt only because it contains the same number of equivalents of chlorine that sodium does of oxygen; and the haloid congeners of common salt, are salts only because their metals unite with oxygen, in the proportion in which their halogen ingredient enters into their composition. Were oxides viewed as salts by Liebig, there might be some consistency in considering other bodies as salts so far as they might have an analogous composition, but in the actual state of the case the definition seems to be unjustifiable. Under this definition how are the sulphides, selenides, tellurides, phosphurets and carburets, to be excluded from the class of salts when consisting of a metal, united with either sulphur, selenium, tellurium, carbon, or phosphorus, in the same proportion as oxygen is capable of combining with the same metal?

45. Liebig refers to the electrolytic experiments of Daniell for support, but those were sufficiently shown to be nugatory, in an essay published in the American Journal of Science and Arts, vol. xlv, for 1843. See also, L. E. Phil. Mag. vol. xxiii, p. 203.

46. It would indeed be miraculous, if all the seven compound radicals existing in the oxacids of sulphur, according to the table above alluded to, should prove to be anions, on subjecting their compounds to electrolysis.

47. There is something in the reaction of muriatic acid with alumine and likewise magnesia, and of water with chloride of aluminium, through which an appeal is made in favor of the ex-

istence of salt radicals. I shall not however prolong the discussion, and render it more abstruse and unpalatable, by entering upon these mysteries. I have said enough to prove that the new doctrine is founded in misapprehension and false reasoning; and should there be some difficulties agreeably to the old doctrine, it is pretty evident that the salt radical theory will not enable us to get out of them.

ART. VI.—*Notice of a new genus of Plants, of the order Santalaceæ;* by ASA GRAY.

(Read before the Boston Natural History Society, March 18th, 1846.)

THE incomplete characters of the plant which is the subject of the present communication, are now published mainly in the hope, that by directing the attention of local botanists towards it, the information which is still needed may be the sooner obtained.

My earliest knowledge of the plant in question, was derived from some specimens in the herbarium of the late Zaccheus Collins, Esq., now belonging to that zealous botanist, Mr. Elias Durand. The specimens were ticketed, "Milledgeville, Georgia, from Dr. Boykin." If they were communicated to Mr. Collins himself, as appears to have been the case, Dr. Boykin was, so far as I can learn, the discoverer of the plant, though perhaps not aware of its interest, since it has not again occurred in the collections of the plants of Georgia, which he has so liberally distributed among northern botanists. It was in the spring of the year 1842 that these specimens fell under my observation, through the favor of Mr. Durand, who obligingly furnished me with a portion of them. They are leafy branches of a shrub, with staminate flowers only.

My next information was received from my friend and correspondent, the Rev. M. A. Curtis, of North Carolina, who, in the summer of 1839, near Lincolnton in that State, noticed a shrub quite new to him, but destitute of any vestiges either of flowers or fruit. Having seen a leafy specimen, I have no doubt of its identity with the plant above mentioned. Mr. Curtis revisited the locality last summer for the special purpose of ascertaining what this unknown shrub could be. He was disappointed, however, being unable to find a single plant of the kind over the whole ground, where it was quite abundant six years ago.

It was with great pleasure that I met with a specimen of this plant, for the third time, in February last, in a small but interesting collection made around Macon, Georgia, by Professor J. Darby, the author of a good elementary treatise on "Southern Botany," and the former principal of a seminary of high character at that place, but who has recently accepted the mathematical chair in Williams College, Massachusetts. The unticketed specimen is finely in blossom, but, much to my disappointment, the flowers all proved to be staminate.

Still, the materials in my possession, imperfect as they are, suffice to show that the shrub in question belongs to the small and highly interesting order of *Santalaceæ*, and that it is nearly allied to the genus *Comandra* of Nuttall. With my present information, I know of no other genus with which it may be immediately compared.

In inflorescence it agrees with Comandra, except that the peduncles are axillary, and the short pedicels strictly umbellate. The calyx, disk and stamens are quite similar, and above all, the anthers are connected with the lobes of the perigonium by the same singular tufts of cobwebby hairs. The observed points of difference are, first, that this new plant is apparently diœcious. The staminate flowers do not exhibit the slightest trace of a gynæcium. The turbinate calyx-tube is accordingly hollow to the very base, and is lined with the thin disk throughout. In the second place, the present plant is a shrub, though attaining to the height of only one or two feet, and presenting somewhat the aspect of a Viburnum; while the two species of Comandra are low herbs, with at most a suffrutescent base; and thirdly, what is of more importance, the leaves, which are alternate in Comandra, are uniformly opposite in our plant. They may perhaps be compared with those of some *Prinos*, or of *Nemopanthes*, Raf. (Ilex Canadensis, *Michx.*) except that they are mostly acute at both ends.

On applying to Professor Darby for further information, I learn that this shrub has been to him an object of special interest for the last ten years, although he has never found it except upon one spot, only a few rods square, where it is abundant, forming bushy shrubs, two or three feet in height. The pistillate flowers appear to be very scarce. In August, 1841, however, Mr. Darby obtained the unripe fruit, which, he remarks, is "baccate, one-celled, one-seeded, apparently inferior, but there is no cohesion of the ovary with the calyx: style one." Mr. Darby had regarded the plant as probably a new genus, but, on account of its free calyx, (having also apparently overlooked the tuft of hairs, &c., in the staminate flowers, which indicate its close relationship to Comandra,) he had referred it to the wrong natural order. Indeed, if the calyx-tube does not cohere with the ovary, an unexpected anomaly in the character of the order Santalaceæ is here presented. We are at present unable to verify this point, Mr. Darby's fruiting specimens having recently been lost by shipwreck, along with many other invaluable specimens and notes, on their way from Georgia.*

In directing the attention of the botanists of upper Carolina and Georgia to this interesting shrub, I would specially request that the pistillate flowers and young fruits may be preserved in spirits, in order, not only that the peculiarity already alluded to may be satisfactorily determined, but more particularly, that the structure of the ovula and the fecundation, so peculiar in this natural family, may be duly studied. For the same reason, specimens of the pistillate flowers of *Pyrularia*, Michx., (the *Hamiltonia* of Muhlenberg,) and also of *Buckleya*, Torrey, preserved in spirits, are particularly desired by the writer.

As I have no doubt that this shrub adds another to our few genera of this interesting order, I am desirous that it should bear the name, and commemorate the botanical services and zeal of Prof. Darby, one of its discoverers, to whom a large part of our still incomplete knowledge of it is mainly owing. I append, therefore, its technical characters, as at present known.

DARBYA, *Gen. Nov. Ord.* Santalacearum.

Flores dioici. *Masc.* Perigonium simplex, turbinatum, ad medium 4–5-fidum; lobis ovatis patentibus. Discus crassiusculus, perigonii penitus tubo adnatus, margine 4–5-crenatus. Stamina 4–5, e sinubus disci, lobis perigonii opposita: filamenta brevia, subulata: antheræ biloculares; loculis fasciculo filarum araneosarum ad basim lobi perigonii annexis. *Fœm.* ignota. Fructus . . . . . stylo unico superatus, unilocularis, monosspermus. Frutex in Georgia et Carolina Superiore vigens, glaber, cortice griseo. Folia opposita, uncialia, membranacea, ovalia, margine integerrima subundulata, breviter petiolata, venosa, subtus pallidiora. Pedunculi axillares, solitarii, folio breviores, ebracteolati, umbellam 3–8-floram gerentes; floribus parvis virescentibus, intus flavidis.

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* In answer to a particular inquiry, Mr. Darby informs me, by letter, that his memory is not positive as to the want of cohesion between the calyx and the ovary, and that some notes made with the plant before him, were lost with the fruiting specimens. He remarks, also, that the mature fruit was not soft and pulpy, as he supposed from the earlier stage it would prove to be. It is therefore probably similar in texture to that of Pyrularia, or Buckleya, or perhaps even dry, like that of Comandra.

Sp. Darbya umbellulata.—Hab. Near Milledgeville, Georgia, *Dr. Boykin*, and at Macon, *Prof. Darby:* also at Lincolnton, North Carolina, *Mr. M. A. Curtis.*

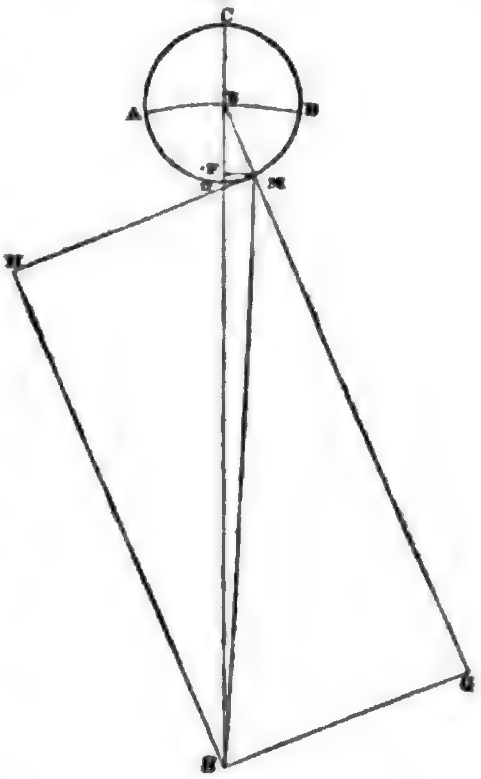
I intended here to record some observations made last season upon the ovula and fecundation of Comandra, which, although exhibiting the same general plan as in Thesium, according to the investigations of Decaisne, appear to differ considerably in some particulars. But as the season approaches when I may be able to repeat and extend the examinations, these remarks are for the present deferred.

Art. VII.—*Variation, or the alternate Acceleration and Retardation of the Moon in the different quadrants of its orbit;* by James H. Coffin.

In the year 1590 Tycho Brahe, a Danish nobleman and a zealous astronomical observer, discovered the fact that the moon moves faster when it is new or full than at other times, and slowest when it is midway between these points, or in quadrature, and consequently that it is alternately accelerated and retarded in alternate quadrants of its orbit. This inequality we denominate *variation.* The cause of it was not known till the discovery of the principle of universal gravitation by Sir I. Newton, when it was shown to be a necessary consequence of the sun's attraction.

In an article on the *secular acceleration of the moon's mean motion*, published in the Journal of Science and Arts for October, 1844, it was shown that if we take the quantity of matter in the earth as the unit by which to measure other quantities of matter,

Fig. 1.



and its attraction on the moon at the mean distance as the unit by which to measure other attractive forces, the quantity of matter in the sun would be 354936, (which number we call S,) and its mean attraction on the moon during a lunar revolution $\frac{S \times EB^2}{SE^2}$, (fig. 1.)

The whole attractive force of the sun upon the moon at any point M of its orbit was represented by the letter *m*, and was resolved into two others in the directions ME and ES. The expression for the disturbing force in the latter direction was shown to be $\frac{3EF}{SM}m$, which was again resolved into two others in the directions EG and GS or MH. For the former of these, known in astronomy as the *ablatitious* force, we obtain the expression $\frac{3EF^2}{SM \times ME}m$. The latter, which we are now to examine, is called the *tangential* force, because it acts in the direction of a tangent to the moon's orbit at the point M.

The proportion for obtaining it will read ES : SG, or by similar triangles, CM : MF :: $\frac{3EF}{SM}m$: the tangential force $= \frac{3(EF \times MF)}{SM \times EM}m$. By the principles of trigonometrical analysis, $EF \times MF = \frac{1}{2}EM \times \sin 2MED$. Substituting this value in the place of EF × MF, the expression for the tangential force becomes $\frac{1\frac{1}{2}EM \times \sin 2MED}{EM \times SM}m = \frac{1\frac{1}{2}\sin 2MED}{SM}m$. Owing to the great distance of the sun, all the terms in this expression are nearly constant, while the moon is passing through a quadrant, except sin2MED. Consequently the tangential force must be nearly proportional to this term, and the others may be taken at their mean value. The mean value of *m* we have given above $= \frac{S \times EB^2}{SE^2}$, and that of SM is evidently SE.

When MED$=45°$, and consequently 2MED$=90°$, its sine becomes EB, and the expression for the tangential force becomes $\frac{1\frac{1}{2}\mathrm{EB}}{\mathrm{SM}}m$. Or by giving to m and SM their mean values it becomes $\frac{1\frac{1}{2}\mathrm{EB}}{\mathrm{SE}}\times\frac{\mathrm{S}\times\mathrm{EB}^2}{\mathrm{SE}^2}=\frac{1\frac{1}{2}\mathrm{S}\times\mathrm{EB}^3}{\mathrm{SE}^3}$.

Restoring the numerical value of S, viz. 354936, and giving to EB and SE their mean values, viz. EB$=237577$ miles, and SE$=95024608$ miles, the value of the expression last found becomes ·008306625. Its mean value through each octant must be proportional to the mean sine in a quadrant, which is the sine of 39° 28′ nearly $=$·63563. Hence, 1 : ·63563 : : ·0083066 : the mean tangential force in an octant or a quadrant, which is thus found to be ·00528.

Increments or decrements of velocity are proportional to the forces that produce them, and consequently the total velocity acquired or lost is proportional to the sum of the forces, whether they be uniform or variable in their operation. Hence the amount which the moon gains or loses in velocity while passing through a quadrant, is precisely the same as it would be if the tangential force remained all the while in its mean state; and to see more clearly what this amount is, let us compare the tangential force with some other, with whose accelerating power we are familiar.

The force of gravity at the earth's surface, we know, draws a body $16\frac{1}{12}$ feet per second, or 57,900 feet per minute, thus creating in one minute a velocity of double that amount, or 115800 feet per minute. But as the moon is about $60\frac{1}{10}$ times as far from the center of the earth as the earth's surface is, the diminished force of gravity at that distance would give a velocity only about $\frac{1}{3606}$ as great, or about $32\frac{1}{8}$ feet per minute. The mean tangential force being ·00528 of the earth's attraction on the moon, will create a velocity of only this fraction of $32\frac{1}{8}$ feet per minute, which is equal to about $2\frac{1}{25}$ inches. Multiply this by $5315\frac{1}{2}$, the number of minutes it takes the moon to describe a synodical octant,* and we obtain about 904 feet per minute, as the velocity acquired or lost by the moon while passing through an octant, which must be the amount by which its velocity exceeds the mean in syzygy, or falls short in quadrature. The mean rate of the moon's motion in its orbit being about 200224 feet per minute, the velocity in syzygy must exceed the mean by about $\frac{904}{200224}$ or $\frac{1}{222}$, and that in quadrature fall short by the same fraction. Consequently, so far as the cause we have now considered is concerned, the numbers 221, 222, and 223 are proportional to the velocity in quadrature, the mean velocity, and the velocity in syzygy.

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* The term octant is not strictly true, for by reason of the earth's progressive motion in its orbit, the moon describes an arc of 97° 16′ 35″ in passing from syzygy to quadrature or from quadrature to syzygy, and consequently there is 48° 38′ 17½″ in the arc which we have called an octant. We employ the term for the sake of conciseness.

We have thus far supposed the moon's orbit to retain its circular form, notwithstanding the disturbing influence of the sun; but this is not possible. To retain a body in a circular orbit, the centripetal and centrifugal forces must be equal. But we have just shown that the velocity in syzygy is greater than in quadrature; and as the centrifugal force is proportional to the square of the velocity, it must also be greater. On the contrary the expression for the ablatitious force, viz. $\frac{3\text{EF}^2}{\text{SM}\times\text{ME}}m$, becomes 0 when the moon is in quadrature at A or B, but is increased when it is in syzygy at C or D so as to become $\frac{3\text{ME}^2}{\text{SM}\times\text{ME}}m=\frac{3\text{ME}}{\text{SM}}m$. On giving to m and SM their mean values, as found above, the expression becomes $\frac{3\text{S}\times\text{ME}^3}{\text{SE}^3}$. It will be seen by a comparison of the terms, that this is just double the maximum tangential force, and as the numerical value of that, expressed in decimals of the moon's mean gravity towards the earth, was ·008306625, this must be ·01661325, or about $\frac{1}{60}$. Consequently the moon's gravity toward the earth at A or B is to its gravity at C or D in the ratio 60 : 59.

The force of gravity being thus diminished, and the velocity increased when the moon is in syzygy, the centrifugal force exceeds the centripetal, which causes the moon's track to fall without the circle, as to F and G, (fig 2.) But when the moon is in quadrature the centripetal force exceeds the centrifugal, causing it to fall within its circular orbit as to L and N.

Fig. 2.

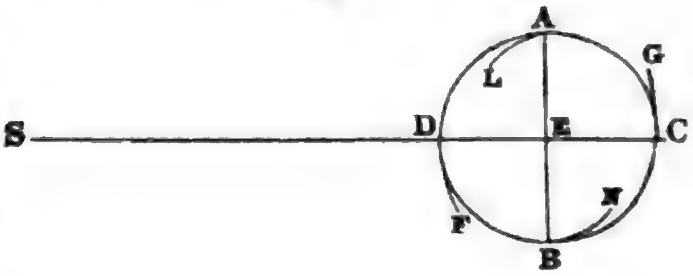
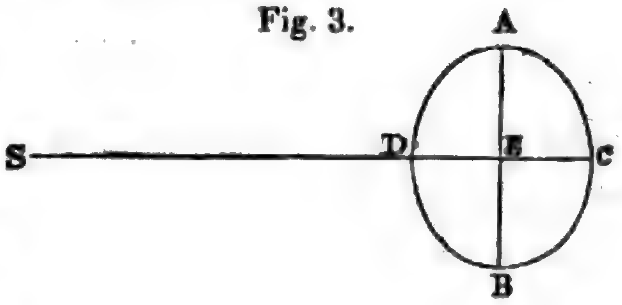


Fig. 3.



The effect is to throw the orbit into something such a shape as is represented in fig. 3, viz. a kind of oval, with its longest diameter, AB, at right angles to the line ES, drawn from the earth to the sun.

By this change both the moon's gravity toward the earth, and its velocity, are still farther affected; its gravity because its distance from the earth being not now the same in all parts of its orbit, the attractive force of the latter varies in the inverse ratio of the square of the distance; and its velocity because the direction of its motion being rendered oblique to the radius vector, the earth's attraction conspires with the tangential force of the sun to accelerate it while passing from quadrature to syzygy, and retard it while passing from syzygy to quadrature. Indeed so far as the attractive force of the earth is concerned, being directed toward a fixed point, the moon describes equal areas in equal times about the earth as a centre, and consequently the velocity at C or D : the velocity at A or B : : EA : ED.

There are two reasons then why the velocity of the moon is greater in syzygy than in quadrature; 1st, the tangential force of the sun, which increases it in the ratio 221 : 223; and 2d, the oblique action of the earth's attraction on the moon in its disturbed orbit, which increases it in the ratio ED : EA. Hence from both combined it is increased in the ratio $221 \times ED : 223 \times EA$.

There are also two causes which affect the moon's gravity toward the earth; 1st, the ablatitious force of the sun, which makes it less in syzygy than in quadrature in the ratio 60 : 59; and 2d, the unequal attraction of the earth in the disturbed orbit, which makes it greater in the ratio $ED^2 : AE^2$. Hence from both combined, the gravity in quadrature : the gravity in syzygy $: : 60 \times ED^2 : 59 \times EA^2$.

A near approximation to the shape of the oval, or to the ratio between its least and greatest diameters, can be determined without much difficulty.

It is a law of central forces that the radii of orbits are proportional to the square of the velocity divided by the centripetal force. Hence the moon's orbit at C and D must be described with a longer radius than at A and B, in the ratio $\frac{(223 \times EA)^2}{59 \times EA^2}$:

$\frac{(221 \times ED)^2}{60 \times ED^2}$, or about 672 : 649. If it be inquired how the radius can be longer and yet the moon nearer the earth, we reply that owing to the disturbing influences that we have been considering, the moon does not revolve around the earth as a centre, but round a point more distant at C and D, and less so at A and B.

As this oval is very nearly an ellipse we may regard it as possessing its properties, considering AB as the transverse and CD the conjugate axis. Now it is proved in works on the conic sections, that the radius of curvature at any point in an ellipse is proportional to the cube of the diameter conjugate to that which passes through that point. Hence, $AB^3 : CD^3$: : the radius of a circle having the same curvature as the oval at C or D : that of one having the same curvature as the oval at A or B. But these radii we have proved to be to each other in the ratio 672 : 649; therefore $AB^3 : CD^3$: : 672 : 649, and AB : CD : : $\sqrt[3]{672} : \sqrt[3]{649}$: : 1 : 1·0117. Sir I. Newton and after him other astronomers have resolved the problem with more accuracy than is here attempted, taking into account some minor circumstances that we have disregarded, and make the ratio 1 : 1·0147, or about 68 : 69.

It has been already shown that the absolute velocity of the moon in quadrature : its absolute velocity in syzygy : : 221 × ED : 223 × EA. But adopting Sir I. Newton's result, ED : EA : : 68 : 69; therefore the absolute velocity in quadrature : the absolute velocity in syzygy : : 221 × 68 : 223 × 69 : : 15028 : 15387. And the difference of the apparent or angular velocity is still farther increased in the ratio 68 : 69, by reason of the diminished distance of the moon from the earth when in syzygy. Hence, from all causes combined, the angular velocity in quadrature : the angular velocity in syzygy : : 15028 × 68 : 15387 × 69 : : 51 : 53 nearly; and the numbers 51, 52, and 53 are proportional to the velocity in quadrature, the mean velocity, and the velocity in syzygy.

The moon's mean horary motion is 1977″; hence according to our calculations it must exceed that in syzygy by 38″, and be less in quadrature by the same amount. According to the most accurate observations the difference is about 41″.

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Art. VIII.—*Observations on the Eocene formation of the United States, with descriptions of species of Shells occurring in it;* by T. A. Conrad,—(with plates.)

(No. 2. Continued from page 221.)

Crassatella.

This genus is not recognized with certainty in deposits older than those of the Cretaceous strata, in which I discovered two species in New Jersey. Five occur in the American Miocene, but the Post-pliocene contains none, nor is there a recent species known to inhabit the coast of North America. Deshayes enumerates twenty-four species in the tertiary formations of Europe; fourteen of which are in the Paris Eocene.

Crassatella alta. Suborbicular, thick and ponderous, slightly ventricose above, somewhat compressed inferiorly; surface with coarse lines of growth, beaks submedial, separated; umbo transversely sulcated towards the summit; dorsal margins equally and profoundly oblique; posterior margin direct, truncated; posterior dorsal area profoundly depressed; lunule large, elliptical, very profound, deepest at the anterior extremity; cardinal plate profoundly dilated, the fosset extending not more than half the width of the hinge plate; in the left valve, behind the large tooth and beneath the fosset, is a deep triangular cavity; inner margin crenulated. (Plate III, fig. 1.)

C. alta, Con.; Foss. Shells of Tert. Form., p. 31, plate vii. Desh., Lam.; Anim. sans Vert., vol. vi, p. 116.

Claiborne, Alabama.

This large species is allied to *C. tumida*, Lam., an Eocene fossil of the Paris basin. It is proportionally more elevated, and Deshayes remarks that the hinge is less strongly articulated. It is common at Claiborne, and rarely occurs with connected valves. I found casts of this shell near Long Branch, N. J., where a bed of infusorial earth of Eocene date also occurs.

Crassatella protexta. Somewhat elliptical, elongated; lower half of the valves sulcated; umbo and beak with fine, closely arranged regular sulci; valves somewhat contracted anteriorly, tumid on the posterior part of the umbo; umbonial slope prominently folded; posterior slope rugose; posterior extremity obliquely truncated; umbo carinated on the umbonial slope; basal margin sinuous; inner margin finely crenulated. (Plate III, fig. 2.)

C. protexta, Con.; Foss. Shells of Tert. Form., p. 22, plate viii, fig. 2.

Claiborne, Alabama.

A very abundant species, rarely found with united valves. It is variable in form, and very young shells have the whole disk sulcated; they are proportionally much shorter than adult specimens, and of a trapezoidal outline.

Plate III, fig. 4, represents outlines of two varieties of the immature shell.

Crassatella alæformis. Oblong-ovate, convex, with distinct lines of growth, which towards the anterior margin become regular, prominent striæ; umbo and beak flattened and profoundly sulcated; anterior margin of the umbo gibbous; posterior side produced, cuneiform, obliquely truncated at the extremity; umbonial slope somewhat angulated; lunule elliptical, profound; inner margin finely crenulated. (Plate III, fig. 3.)

C. alæformis, Con.; Jour. Acad. Nat. Sci., vol. vi, p. 228, plate x, fig. 1.

Piscataway, Prince George's Co., Maryland.

I found a single valve of this species in 1830 in the sandy marl, or mixture of siliceous sand, clay and green sand, where it accompanies Cardita planicosta and many other Eocene shells. I have since obtained two more valves, and find the outline to be very uniform in this species.

Crassatella rhomboidea. Oblong, rhomboidal; anterior margin obliquely subtruncated at base; posterior margin obliquely and widely truncated, the inferior extremity rounded; posterior dorsal margin not very oblique; basal margin slightly curved. (Plate III, fig. 5.)

Orangeburg, S. C.

This is a cast in indurated clay, presented by Dr. Wm. Blanding. The outline is more perfectly rhomboidal than in any other American species. Mr. Vanuxem obtained similar specimens in the same district of South Carolina.

Crassatella palmula. Ovato-trigonal, profoundly compressed, the umbo almost rectilinear; dorsal margins very oblique, equally declining, the ligament margin straight; the anterior margin swelling slightly; apex nearly central; posterior extremity truncated? (Plate IV, fig. 1.)

Upper Marlborough, Prince George Co., Maryland.

A single imperfect valve is all I found of this species. It is remarkably flat, particularly over the umbo. It was imbedded in a hard rock or indurated marl, and is composed of crystallized carbonate of lime.

AMPHIDESMA.

The oldest known species of Amphidesma of Lamarck, occur in the Eocene. Only one fossil species was known to Deshayes when he published his table in 1833. In the American Eocene I find three species; in the Miocene, eight; and two recent ones occur on the Keys of Tampa bay, Florida.

Deshayes supposed this to be an artificial genus as grouped by Lamarck; but of all the bivalve genera, we know none more natural and easily recognized, considered in reference to American species; although in some there are lateral teeth, in others none, and some species have them in one valve only. The most striking character is the very oblique, elliptical or oblong fosset. Perhaps the genus might rank next to *Mesodesma* in the family Mactridæ.

AMPHIDESMA LINOSA. Ovate, plano-convex with fine regular concentric prominent lines; right valve with a somewhat prominent obtuse fold over the umbonial slope, the base of which is emarginate; posterior side short; extremity subtruncated or very obtusely rounded, direct; beaks slightly prominent; fosset produced, elliptical. (Plate IV, fig. 2.)

A. linosa, Con.; Foss. Shells of Tert. Form., p. 42.

Claiborne, Alabama.

I have only two valves of this species, which much resembles a Tellina exteriorly. The palleal sinus is very profound. In the right valve are two diverging compressed cardinal teeth, and the lateral teeth are very distinct.

AMPHIDESMA TELLINULA. Subovate or subtriangular, thin, ventricose; dorsal margins very oblique, the posterior one rectilinear; posterior side narrower and rather shorter than the anterior, extremity truncated and very much above the line of the base; basal margin profoundly rounded; cardinal tooth double; fosset small; lateral teeth obsolete. (Plate IV, fig. 5.)

Claiborne, Alabama.

Of this species I have but one left valve. The fosset of the hinge is shorter than is usual in the genus, and much less oblique or more direct; the tooth which is anterior to the fosset is double, and before it there is a minute pit; posteriorly, the hinge has a narrow elliptical depression or lunule, which gives the shell the appearance of a lateral tooth.

CORBULA.

Corbula of Lamarck is a very ancient genus. I found one species in the Silurian rocks of New York. Others occur in the Carboniferous limestones of Europe, in the Lias, Oolite, green sand and Gault. In the Tertiary, Deshayes enumerates thirty five species. I have not observed the genus in the Cretaceous strata of this country. I find two in the Eocene, and four in the Miocene. One recent species inhabits the coasts of Massachusetts and the Carolinas, (*C. contracta*, Say,) which occurs also in the Post-pliocene of Maryland; and another recent species I obtained from a sounding lead in deep water in the Gulf of Mexico.

CORBULA NASUTA. Ovate-trigonal, ventricose, concentrically striated; beaks medial; posterior extremity of larger valve rostrated, the extremity obliquely truncated; umbonial slope of both valves carinated. (Plate IV, fig. 4.)

C. nasuta, Con.; Foss. Shells of Tert. Form., p. 38, Aug. 1833.

C. Alabamiensis, Lea; Cont. to Geol., p. 45, plate i, fig. 12, Dec. 1833.

Claiborne, Alabama.

The valves of this common species are nearly equally convex, and the striæ on both valves about equal in size and approximate. In some specimens the basal margin is slightly contracted. The valves are suddenly rounded or curved inwards towards the base.

CORBULA ONISCUS. Triangular, profoundly ventricose, larger valve with concentric acute prominent striæ, profound on the back, obsolete towards the extremities; umbonial slope carinated, terminal, the posterior slope or area being profoundly depressed and carinated; posterior end suddenly rostrated, rostrum reflected, extremity truncated; lesser valve with numerous concentric wrinkled approximate lines, and carinated near the posterior extremity; beaks submedial. (Plate IV, fig. 3.)

C. oniscus, Con.; Silliman's Amer. Jour. of Science, vol. xxiii, p. 342, Jan. 1833. Lea.; Cont. to Geol., plate i.

Claiborne, Alabama; Washita river, Louisiana.

This species is common at Claiborne, and is remarkably like *C. angustata*, Sow.; and is also allied to *C. ombonella*, Desh., a fossil of the Paris Eocene. It was by means of this species that I was able to recognize an Eocene deposit on the Washita river, Louisiana, as it adhered imbedded in sand to the Zeuglodon bones sent from there. At Claiborne it is occasionally found with united valves.

One right valve much larger than usual, from Claiborne, has much more numerous, proportionally smaller, and more approximate and unequal concentric striæ.

TELLINA.

The genus *Tellina*, Lin., is supposed to be as ancient as the Oolitic period. Mr. Phillips describes a species of the Coral Rag, but its generic character is uncertain. Deshayes's table gives fifty four tertiary species; eighteen in the Paris Eocene; four in the London clay, and four in the English Miocene. I have discovered five in the American Eocene and five in the Miocene, one of which is a recent speces, (*T. lusoria.*) Two recent species inhabit the coast of Massachusetts, and a few others are known on the southern coast. I found five species in Tampa Bay, Florida. The common *T. radiata* inhabits the eastern coast of Florida as far north as Fort Lauderdale, above Cape Florida.

TELLINA SILLIMANI. Subtriangular, compressed, thin; left valve with a prominent acute fold over the umbonial slope, which is straight; posterior side shorter than the anterior; the dorsal line straight and oblique; the end margin obliquely truncated, and the extremity truncated; surface marked with brown concentric bands; valve contracted widely from beak to base between the middle and umbonial slope. (Plate IV, fig. 9.)

Claiborne, Alabama. Very rare.

TELLINA PAPYRIA. Elliptical, subequilateral, very thin and compressed, with minute regular concentric impressed lines, obsolete on the posterior side; anterior end acutely rounded; posterior extremity angulated; beaks scarcely prominent; apex acute; cardinal teeth prominent; lateral teeth none. (Plate IV, fig. 7.)

Tellina papyria, Con.; Foss. Shells of Tert. Form., p. 41.

Claiborne, Alabama. Very rare.

TELLINA ALTA. Suborbicular, inequivalved, inequilateral, with lamelliform concentric lines, not closely arranged, and minute closely arranged radiating wrinkles; posterior side obtusely folded, the inferior margin truncated obliquely inwards; lateral teeth distinct; the posterior one very short, pyramidal, remote. (Plate IV, fig. 10.)

T. alta, Con.; Foss. Shells of Tert. Form., p. 41.

Claiborne, Alabama. Very rare.

In this species one valve is considerably more convex than the other, and the anterior muscular impression is rather deeply impressed, and bounded on the inner side by a broad rib-like elevation, which extends to the apex.

TELLINA PLANA. Scaleniform, very much compressed, very inequilateral, smooth and polished; substance of shell very thin; beaks very small and pointed; lateral teeth lamellar. (Plate IV, fig. 6.)

Egeria plana, Lea; Cont. to Geol., p. 54, plate i, fig. 25.

Claiborne, Alabama.

TELLINA RAVENELI. Suboval, inequilateral, moderately thick, with very fine regular concentric lines and with brown bands; anterior margin obliquely truncated above; posterior side obtusely folded; beaks a little prominent; lateral teeth large and prominent, compressed; area above the anterior lateral tooth dilated. (Plate V, fig. 1.)

Claiborne, Alabama.

Of this species I have only an imperfect right valve. Its most remarkable character is the somewhat angulated form of the anterior dorsal margin. It is dedicated to Dr. Ravenel of Charleston, S. C.

TELLINA SCANDULA. Ovate, much compressed; anterior margin rounded; ligament margin very oblique, slightly curved; fold near the posterior margin, angulated, subcarinated; basal margin rounded; beaks scarcely prominent above the hinge line, submedial, nearest the anterior end. (Plate IV, fig. 8.)

T. scandula, Con.; Jour. Acad. Nat. Sciences, vol. vii, p 132.

Claiborne, Alabama.

I found only one valve, a right one, and this is imperfect; the cardinal plate is broad and thick, with two diverging compressed teeth, and no lateral teeth. The substance of the shell is moderately thick.

CORBIS.

The genus Corbis of Cuvier originated in the Eocene period. Two species occur in the Paris Eocene, one of which is also found at Claiborne, Alabama, but is so rare that I have seen but one valve. Lamarck describes but one recent species, an inhabitant of the Indian Ocean.

Corbis undata. Ovate, ventricose, with about twelve concentric ribs or undulations, very strongly prominent, acute, remote on the umbo, lamelliform towards the apex, but thick, less prominent and approximate towards the middle of the valve; on the inferior half of the valve are irregular concentric compressed lines; disk with radiating lines, obsolete on the middle of the inferior half of the valve, profound on the sides, crenulated on the anterior side; posterior side with distant prominent lamellæ, five or six in number; beaks medial; inner margin crenulated. (Plate IV, fig. 11.)

Corbis undata, Con.; Foss. Shells of Tert. Form., p. 40.

C. distans, Con.; ib. (Immature shell.)

Claiborne, Alabama.

A beautiful and very rare species. Immature shells have acute prominent remote ribs, covering the whole disk, and are comparatively less ventricose than mature specimens.

Corbis lamellosa. Elliptical, compressed, with distant elevated lamelliform ribs, and fine radiating striæ; ribs towards the base less remote and more robust; on the posterior slope the laminæ are more profoundly elevated. (Plate IV, fig. 16.)

Corbis lamellosa, Lam.; An. sans Vert. Chemnitz; Conch., vol. vi, tab. xiii, figs. 137, 138. Encyc. Meth. plate cclxxxvi, figs. 2, a ,b, c. Desh.; Coq. Foss., t. i, plate xiv, figs. 1, 2, 3.

Claiborne, Alabama.

The extreme scarcity of this shell at Claiborne is remarkable, as it is very abundant in the Paris Eocene. It varies little from the Paris specimens, the principal difference being in the thicker and more approximate ribs towards the base.

LUCINA.

The genus Lucina of Bruguière is very numerous in fossil and recent species. Deshayes enumerates as many as fifty nine tertiary species, thirty one of which are in the Paris Eocene. The number, however, will be somewhat restricted by separating the group termed Loripes by Poli. In Europe the genus is supposed to occur as low as the Great Oolite. The Eocene of this country contains seven known species; the Miocene twelve, of which seven are living inhabitants of the coasts of the Union. Of these, two live as far north as Massachusetts, L. radula, (L. contracta, Say,) and L. divaricata, both of which also inhabit the European coasts of the Atlantic. The others inhabit the coasts of Carolina and Florida, and one of them, L. crenulata, occurs at Cape Henry, Virginia. I obtained six species about Tampa Bay. One of these, L. Floridana, is very nearly allied to the Miocene L. anodonta, Say. The genus is more largely represented in our Miocene beds, by recent species, than any other group of shells.

LUCINA ALVEATA. Ovate, ventricose, with prominent concentric lines, and remote profound concentric sulci; summits very elevated, medial; posterior margin truncated, direct; posterior side with an indistinct submarginal fold; cardinal and lateral teeth distinct; inner margin crenulated. (Plate IV, fig. 12.)

Lucina alveata, Con.; Foss. Shells of Tert. Form., p. 40, Nov. 1, 1833.

L. lunata, Lea; Cont. to Geol., plate i, fig. 32, Dec. 1833.

Claiborne, Alabama.

A variable species; some specimens have a distinct fold, others none; the sulci vary much in number, generally from two to five. Occasionally traces of radiating lines are visible under a glass, which are most distinct on the margins of the sutures.

LUCINA CARINIFERA. Suborbicular, profoundly ventricose, with concentric acute striæ; anterior side with a slightly impressed fold, and the superior margin with a short rostrum or prominent angle; posterior side with a narrow, profoundly impressed fold, emarginate at base; summits very prominent, submedial; beaks incurved; cardinal and lateral teeth distinct; inner margin crenulated. (Plate IV, fig. 15.)

Lucina carinifera, Con.; Foss. Shells of Tert. Form., p. 40, Nov. 1, 1833.

L. cornuta, Lea; Cont. to Geol., plate i, fig. 29, Dec. 1833.

Claiborne, Alabama. Rare.

LUCINA POMILIA. Suborbicular, equilateral, convex or slightly ventricose, with remote profound concentric sulci, and obsolete striæ; an obscure trace of radiating lines; an impressed fold near either end margin, truncated, or somewhat emarginate at base; beaks prominent and pointed; cardinal and lateral teeth distinct; inner margin minutely crenulated. (Plate IV, fig. 17.)

Lucina pomilia, Con.; Foss. Shells of Tert. Form., p. 40, Nov. 1, 1833.

L. impressa, Lea; Cont. to Geol., plate i, fig. 30, Dec. 1833.

Its varieties approach so near to those of the preceding species, that it may not be really distinct. It is usually less ventricose and less elevated and more distinctly folded. In some specimens the posterior fold is profound.

LUCINA MODESTA. Orbicular, ventricose, thin, with minute approximate concentric lines; posterior side with an impressed submarginal fold; posterior margin truncated, direct; ligament margin straight and oblique; beaks prominent, medial. (Plate IV, fig. 13.)

Claiborne, Alabama. Rare.

LUCINA SUBVEXA. Suborbicular, profoundly ventricose, with fine concentric and minute obscure radiating lines; posterior side with a fold consisting of two furrows, the submarginal one obscure; radiating lines minute and obscure; anterior margin elevated and angulated at the extremity of the hinge line; anterior side with an obsolete fold; posterior margin truncated, direct; umbo ventricose; beaks medial; hinge narrow, edentulous; within profoundly punctate. (Plate IV, fig. 14.)

Lucina subvexa, Con.; Foss. Shells of Tert. Form., p. 40.

Claiborne, Alabama.

A rare species. I have but one valve, which is thin about the basal margin, thicker above, with a rough unequal radiato-punctate interior; the lunule small and impressed, and the hinge plate narrow and without teeth.

Explanation of the Plates.

PLATE III.

Fig. 1. Crassatella alta.
2. C. protexta.
3. C. alæformis.
4. Outlines of immature shell of C. protexta.
5. C. rhomboidea.

PLATE IV.

Fig. 1. Crassatella palmula.
2. Amphidesma linosa.
3. Corbula oniscus.
4. C. nasuta.
5. Amphidesma tellinula.
6. Tellina plana.
Fig. 7. T. papyria.
8. T. scandula.
9. T. Sillimani.
10. T. alta.
11. Corbis undata.
12. Lucina alveata.
13. L. modesta.
14. L. subvexa.
15. L. carinifera.
16. Corbis lamellosa.
17. Lucina pomilia.

PLATE V.

Fig. 1. Tellina Raveneli.

Catalogue of recent shells, which occur also fossil in the Miocene deposits in the United States.

Since I enumerated the proportion of recent species in Miocene deposits in the Proceedings of the Academy of Natural Sciences, I have obtained others and identified some more in my cabinet, and every new research in those beds must bring others to light, varying in some slight degree the proportion of living and extinct species.

Bivalves.

1. *Artemis acetabulum*, Con. Florida.
2. *A. elegans*, Con. Florida.
3. *Astarte lunulata*, Con. Charleston.
4. *Arca improcera*, Con. Southern coast.
5. *Anomia ephippium*, Lin.
6. *Amphidesma equale*, Say. Southern coast.
7. *Cardita tridentata*, Say. Southern coast.
8. *C. granulata*, Say. Southern coast.
9. *Chama arcinella*, Lam. Southern coast.
10. *Cumingia tellinoides*, Con. Southern coast, Massachusetts.
11. *Cultellus caribæus.* Southern coast, Massachusetts, New Jersey.
12. *Cytherea elevata*, Con. Gulf of Mexico.
13. *C. Sayana*, Con. Rhode Island, Massachusetts, New Jersey.
14. *Lucina crenulata*, Con. Cape Henry, Virginia.
15. *L. divaricata*, Lam. Atlantic coast.
16. *L. jamaicensis*, Lam. West Indies.
17. *L. trisulcata*, Con. Florida.
18. *L. radula*, Lam. Rhode Island, Massachusetts.
19. *L. squamosa*, Lam. Southern coast.
20. *Mactra lateralis*, Say. Atlantic coast.
21. *Nucula acuta*, Con. Florida.
22. *N. proxima*, Say. Atlantic coast.
23. *N. limatula*, Say. Massachusetts.
24. *N. acuta*, Con. Gulf of Mexico.
25. *Pecten concentricus*, Say. Atlantic coast.
26. *Tellina lusoria*, Say. Southern coast.
27. *Venus cancellata*, Lam. Southern coast.
28. *V. mercenaria*, Lin. Atlantic coast.
29. *V. metastriata.* Florida.

Univalves.

1. *Cerithium clavulus*, H. C. Lea. Tampa Bay.
2. *C. dislocatum*, Say. Southern coast.
3. *Dentalium coarctatum*, Lam. Gulf of Mexico; Europe.
4. *D. dentale*, Lin. European coast.
5. *Dispotæa rugosa*, (*Calyptræa*,) Brod. South America.
6. *D. corrugata*, (*Calyptræa*,) Brod.; *D. ramosa*, Con. South America.
7. *Crepidula unguiformis*. Atlantic coast.
8. *C. fornicata?* Lam. Atlantic coast.
9. *C. convexa?* Say. Atlantic coast.
10. *Fulgur carica?* Southern coast.
11. *F. canaliculatus*. Atlantic coast.
12. *Natica heros*, Say. Atlantic coast.
13. *N. duplicata*, Say. Atlantic coast.
14. *N. canrena*, Lam. Florida.
15. *Nassa trivittata*, Say. Atlantic coast.
16. *N. obsoleta*, Say. Atlantic coast.
17. *N. lunata*, Say. Atlantic coast.
18. *Oliva litterata*, Lam. Florida.
19. *O. zonalis*, Lam. Florida.

Multivalve.

Balanus ovularis. Atlantic coast.

This makes forty nine recent, out of three hundred and forty four species in my cabinet. The per-centage of recent forms will not vary, I presume, through future discoveries to any great amount.

Art. IX.—*Notices of Fresh Water Shells, &c., of Rockbridge County, Virginia;* by T. A. Conrad.

Last summer, while on a visit to my friend, Constant W. Newkirk, Esq., in Rockbridge County, Virginia, I paid some attention to the Naiades and univalves of the vicinity. The river here is called the "Calf Pasture," and is a small stream flowing through a mountain gorge. It is a branch of North river, which latter unites with James river near the Blue Mountain chain. It may not be uninteresting to conchologists to learn that the second species of Unio known to have spines is abundant in these rivers. I collected a great variety of them, and observed some peculiarities that may not be unworthy of notice. I was indebted to muskrats for all the specimens having spines, except some very young shells which I took alive; and thirty or forty occurred in one spot, in company with the very young of U. lanceolatus. No where else, after a diligent search, could I find the young of either species. On the muddy shore of the river where muskrats resort, especially about the still water of the dams, I procured many specimens of Unio collinus, with spines, which I found to vary in the number and position of these spines; some would have a rather long spine on one valve only, others a spine on each valve; others two short ones on the umbo, ranged in the direction of the shell's length; others with three spines, and some with two ranged in a line from beak to base. One specimen has a spine just below the umbo, and near the base are two thick ones in a line with the shell's length. In very rocky places where the water is rapid I found some living specimens of this species, all destitute of spines, which indeed is the condition of a great majority of the *collinus*. It is worthy of observation that this spinous character prevails most among the specimens in still water where there is a muddy bottom, and least of all where the water is most rapid. On the rocks live vast numbers of Anculosa dilatata, a very variable univalve, and this, with a few specimens of Melania virginica, Ancylus rivularis, Planorbis parvus and Paludina decisa, were the only univalves I noticed. The Unio lanceolatus is abundant, and may be found alive among the rocks and stones. Great numbers always occur, with the animals eaten out, about the muskrat haunts and holes in the banks. Unio subplanus, *Con.*, is not uncommon in similar situations, and U. constrictus, *Con.*, is still more abundant. The latter species and U. purpureus of Say, are the two species most commonly obtained alive.

It is curious to observe the partiality of the muskrat for particular haunts, as is made evident by heaps of shells, the relics of their nightly repasts. A particular rock near shore, surrounded by water, will be seen covered with shells, and on one side of the rock a deep stratum of them in the mud, while other rocks near, apparently equally well fitted for the festive board, are never furnished with a single shell. I have repeatedly visited one of their favorite rocks in a morning, and collected fine specimens which had been fished up and the animal eaten over night. But although Unio collinus was common among them, and the water was shallow, I was unable to find the living specimens whose haunts seem to be so well known to the Naiad-loving quadruped.

Between the different mountain spurs in this wild region, there are beautiful valleys with level and fertile land. The mountains are quite steep and composed of non-fossiliferous rocks of the carboniferous system, but coal does not occur. Iron ore is excellent and abundant, and within a short distance of Mr. Newkirk's furnace. The climate here is about the same as that of the latitude of Philadelphia, the elevation of the land being equivalent to the difference of latitude. But in these wooded and mountain regions the sudden fall of temperature at night, is often very great, particularly after rain, and therefore ill suited to an invalid's constitution.

The shells of Calf Pasture river are comprised in the following list:—

Bivalves.

Unio collinus, *Con.*
U. purpureus, *Say.*
U. constrictus, *Con.*
U. subplanus, *Con.*
U. lanceolatus, *Lea.*
Alasmodon undulata *Say.*
A. marginata, *Say.*
Anodon cataracta, *Say.*
A. marginata ? *Say.*

Univalves.

Planorbis parvus, *Say.*
Ancylus rivularis, *Say.*
Paludina decisa, *Say.*
Anculosa dilatata, *Con.*
Melania virginica, *Say.*

Art. X.—*On the detection of Spirally dotted, or Scalariform Ducts, and other vegetable tissues in Anthracite Coal;* by Prof. J. W. Bailey, of the U. S. Military Academy.

On perusing in this Journal (p. 124, present volume) an account of the results obtained by Schultz and Ehrenberg in the microscopic examination of coal decarbonized by means of nitric acid and heat, I felt a desire to repeat the experiments and obtain if possible some of those "white splinters" which they found "composed of aggregated siliceous cells arranged in regular succession, of the structure of the prosenchymatous cells of wood." But just as I was about to commence the repetition of these experiments, it occurred to me that I might find the decarbonization in every stage of progress, among the masses of some partially burned Pennsylvania anthracite, with which a grate in my room was filled, in which the fire had been allowed to smother itself in its own ashes.

I was not disappointed, for I found that many of the masses of partly burned coal readily separated into numerous laminæ, on almost all of which, when magnified, vegetable structure could be detected, and on many of which the tissues were preserved in a state of unhoped for perfection.

Several varieties of structure presented themselves, the most interesting of which however were well characterized *dotted* or *scalariform ducts*, in a most perfect state of preservation, and forming somewhat rectangular plates, which are often several inches long, and one or more broad. These specimens, whose beauty and perfection can scarcely be exaggerated, present all the original markings of the vessels with a distinctness which leaves scarcely any thing to be wished for. They may be examined either as opaque objects, in which case the silica appears in relief against the black coal, and shows the form and markings of the tubes very finely; or still more satisfactory results may be obtained by melting some inspissated Canada balsam upon a plate of glass, and while melted touching it to a surface of the coal upon which the ducts had been previously found to exist. When the balsam has hardened, the coal may be pulled off, and it will be found that it leaves fixed upon the balsam a thin layer of silica, containing perfectly preserved dotted vessels, which when viewed as transparent objects, are nearly as distinct in their markings as if freshly obtained from a recent plant. (See the figures, p. 410.) I have a large number of specimens, and hope to find means to place them in the hands of all interested in such researches.

Besides the dotted vessels, which appear to be something very different from the "prosenchymatous cells of wood" obtained by Schultz, other tissues occurred, among which were small masses of woody fibre with no definite markings, also layers appearing to be composed of the cells of the epidermis of the stem of some plant, and, rarely, traces of tissue presenting what appear to be the remains of Stomatæ. All these require a more careful study before any very definite conclusion can be drawn from them.

A few inferences appear however to be fairly deducible from the examination already made, viz.

1. It appears that almost every layer of the coal is composed of vegetable matter, which still retains very distinct remains of

the original organic structure, and which consequently could never have been reduced to a homogeneous pulp.

2. The plants from which the coal was *chiefly* formed do not appear to have been allied either to the Coniferæ, or the ordinary Dicotyledonous or Monocotyledonous plants. Their nearest analogues must probably be sought among the Acotyledons, among which Ferns and Lycopodiaceæ present similar vascular bundles, composed chiefly of bothrenchymatous tissue.*

3. Even allowing for the effects of compression, it does not appear probable that the petioles of even the tree ferns could have furnished such large flattened plates of scalariform ducts unmixed with other tissues as are found in the coal, and which *very rarely* have any traces of fronds of ferns preserved in the same mass.

4. It is possible that the ducts in question may really have belonged to the Stigmaria itself. Lindley and Hutton, from the examination of a magnified section of a silicified Stigmaria, pronounce it to be a plant whose woody portions were entirely composed of *spiral vessels;* but their figure of these vessels, however interesting, leaves some room to suppose that *spirally dotted ducts* partly obscured by petrifaction might have been mistaken for true spiral vessels. (See Fossil Flora of Great Britain, vol. iii, plate 166.) This view is confirmed by Unger, who attributes dotted ducts alike to the Stigmariæ and the woody layers of Lepidodendreæ and Sigillariæ. (Endl. Gen. Plant. sup. 2, pp. 5, 6.)

5. Vascular bundles must certainly have extended from the scars found on the Stigmaria and Sigillaria to the deciduous appendages, (see Foss. Flora, vol. i, plates 31, 32, and 33,) whether these latter were leaves or radical fibres, and the partial decay of masses composed of numerous layers of such appendages, would account for most of the appearances observed in the coal.

6. The proofs afforded by these examinations, that the coal is composed of layers, of great tenuity, of vegetable matters scattered in a confused manner, and that no trunks of trees or any considerable portion of their branches had any thing to do with its formation, are in exact accordance with the inferences drawn by Prof. H. D. Rogers, from an examination of the mechanical structure of unburned coal.†

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* Since the above was written, I have observed that Ad. Brongniart, in a recent number of the Comptes Rendus, maintains that Stigmaria, Sigillaria and Lepidodendron, as well as Noeggerathia, are all allied to the Gymnospermous dicotyledons.

† See Transactions of the Association of American Geologists, p. 448.

7. As anthracite is only bituminous coal which has lost its volatile matter, the results obtained from it apply to all varieties of the true coal of the Carboniferous epoch. The presence of bitumen, however, and the consequent swelling and partial fusion of the ordinary coal, render it difficult to obtain from it the tissues in the perfection in which they may be found in anthracite.

Fig. 1.

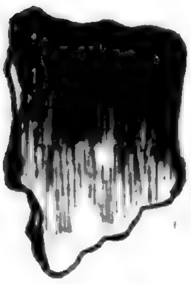


Fig. 2.

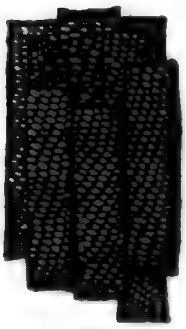


Fig. 3.

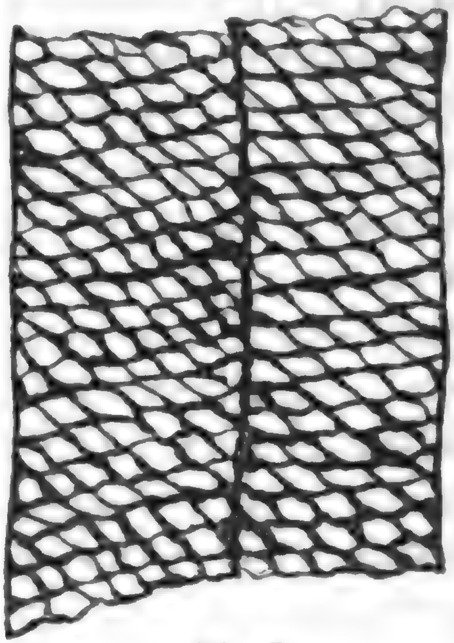
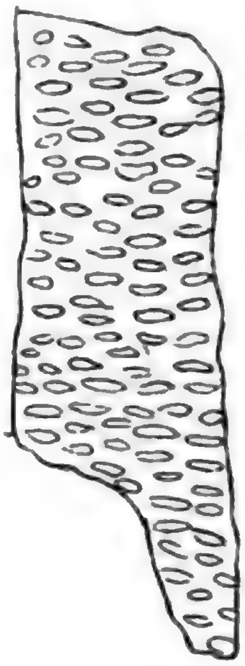


Fig. 5.

Fig. 4.



Explanation of the Figures.

Fig. 1, shows the appearance to the naked eye of a mass of partly burned anthracite, on which the vascular tissue is found. The black portion is the unconsumed coal. The white portions represent the silica left after oxidation of the carbon.

Fig. 2, shows the manner in which the vessels occur in successive superimposed layers. It also gives an idea of the general appearance of the tissue when moderately magnified; the black lines being the unburned coal, the white spaces being spots of silica.

Fig. 3, is a sketch made by the camera-lucida, showing the appearance, as an *opaque* object, of a small portion of two ducts from anthracite, much magnified. The white irregular spaces are patches of silica; all the black lines represent unburned coal.

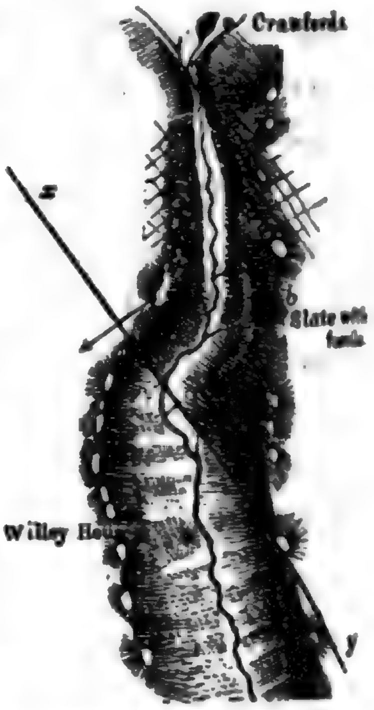
Fig. 4, is a sketch made by the camera-lucida, showing the appearance, as a *transparent* object, of a fragment of a single duct from anthracite, much magnified. The ovoidal spaces are thickened portions of the siliceous plate, and apparently correspond to the pits in the walls of the original tissues.

Fig. 5, shows $\frac{10}{100}$ths of a millimetre, drawn by means of a camera-lucida from a micrometer equally magnified with the two last figures.

Art. XI.—*On the Geological Age of the White Mountains;* by Prof. Henry D. Rogers and Prof. William B. Rogers.

The White Mountains, the most elevated of the mountain masses of the Atlantic side of North America, have been hitherto regarded as consisting exclusively of the granitic and gneissoid rocks under their several modifications, and as having originated in the so-called primary periods of geological time. This common notion of their great antiquity is to be ascribed to the highly crystalline texture of many of their more conspicuous rocky masses, which, until closely scrutinized, do certainly bear a near resemblance to the typical forms of the most ancient gneiss, mica slate and granite. But it involves we conceive two errors, first, that of assigning to all the strata of the gneissoid class, merely in virtue of their crystalline aspect, a date remoter than that of the protozoic or earliest fossiliferous deposits; and secondly, the error of supposing that the strata of these mountains contain no organic remains. So long as their fossiliferous character was undiscovered, the metamorphic condition of these rocks might naturally enough deceive the observer and lead him to false inferences in relation to their age.

Having in the month of July last, enjoyed the opportunity of studying with some care the structure and composition of that part of the chain which is exposed to view in the picturesque and deep defile of the Saco, we had the good fortune to detect in the vicinity of the Notch, the fossiliferous character of a portion of the strata, and to see through the metamorphic disguises in which intense igneous action has obscured these originally sedimentary palæozoic masses. We succeeded in determining some of the organic remains sufficiently to identify thereby some of the formations, much altered as they are from the purely sedimentary aspect, and from these data we have attempted to deduce some inferences respecting the *limit of antiquity* of these mountains, and the date of their elevation. By detecting in many of the pseudo-granitic rocks a genuine sedimentary stratification, we were able to follow in sundry places the true direction of the almost obliterated bedding, and to discover the course of the anticlinal axes. These once clearly recognized, led us finally to conclusions which have much interested us in regard to the structure of the whole chain and the nature of the forces of elevation. In the present short paper we propose to submit a concise abstract of these observations, and the results to which they have brought us.



By inspecting the accompanying little map, the reader will notice that the general direction of the Gorge of the Saco, neglecting the local windings in its course, is nearly from north to south. In one place, about half way between Crawford's and the Willey house, the contracted valley as we trace it south bends abruptly to the westward, and in the distance of perhaps a furlong sweeps back again into its former southerly direction, making a double or sigmoid curve. This feature is especially favorable to the exhibition of the range and dip of the rocks, which are here exposed endwise in the transverse section. In the mountain on the north and west of the Gorge, the end of which is full in front of the traveller as he ascends the valley from the Willey house, the stratified structure of the rocks throughout this gigantic ridge, is plainly to be seen in the differently colored perpendicular belts which outcrop edgewise along its naked and nearly mural face.

At the Notch (represented in the sketch at *a*) the rocks on both sides of the narrow chasm are traversed by two sets of nearly vertical planes or joints, the one running nearly N. E. and S. W., the other nearly N. W. and S. E. Though in this place the stratification is but obscurely indicated, we succeeded in making out the planes of bedding; and in some cases with such satisfactory clearness as to prove the true strike of the beds to be N. E. and S. W., and the dip to be for the most part vertical, but with some local arching. Observations made both at this locality and elsewhere, induced us to regard the rocks of the Gorge generally as a group of highly metamorphic sandstones and slates, traversed by enormous beds and veins of syenitic granite, by the heating agency of which they had for the most part been rendered semi-crystalline, and in some cases had even been transformed into apparent gneiss and granite. At certain points in these altered strata, the original sedimentary structure is still distinctly retained; and at one locality we were so successful as to discover well characterized impressions and fragments of fossils, from which we have been able, safely as we think, to approximate to the geological age of the strata, as well as to the epoch of the earliest movement of elevation.

At the curve in the valley, where the anticlinal axis $x\,y$ crosses the Gorge obliquely, entering the end of the ridge already alluded to, and from that point down to the Willey house, the rocky fragments dislodged from the naked and steep slopes on either side, consist chiefly of a finely laminated hard sandy slate of a bluish color, and a coarse very compact rock of similar composition; and mingled with these are occasionally found masses of the same composition, but wearing a more altered aspect, some of them containing crystalline spots and white amygdaloidal kernels, the obvious indications of an advanced stage of igneous metamorphosis. These fragments are extremely instructive; for they exhibit nearly all the later stages of alteration, from the ordinary sedimentary texture to the diffusedly crystalline one. In some cases we see the planes or lines of sedimentary deposition coexisting with a general but not fully perfected crystallization, in which however may be distinctly discovered genuine *feldspar*, *augite* and *mica*. Such specimens are to be viewed as an incipient hornblendic gneiss, in which through the sedimentary granular structure, typical of the secondary strata, may be seen everywhere and intimately dispersed, the crystallized definite mineral aggregates equally typical of the so-called primary rocks. Many of these specimens seen facewise, would pass for genuine ancient gneiss; but looked at edgewise, they betray equally unequivocal marks of their sandstone nature and origin. Among the more argillaceous altered rocks, are some which have evidently once been sandy shales, but which now consist of a purplish gray semi-crystalline base, imbedding several obscurely developed minerals. These rocks likewise contain serpentine, talc, and other silico-magnesian species, as well as some clearly insulated grains of crystalline quartz.

About one third of a mile below the northern entrance of the Notch, on the west side of the Gorge and therefore not far from the extremely wild and picturesque cascade called the Flume, there occurs especially in the craggy summit of the mountain, a thick-bedded white semi-crystalline altered sandstone, which is intersected by injections of feldspathic granite, and is itself in many parts concreted into a near approximation to a binary granite composed of distinctly developed quartz and white feldspar, with a few sparsely scattered specks of mica. In its weathered surfaces this rock wears a close resemblance to some fine grained quartzo-feldspathic granites, but upon inspecting a fresh fracture with a magnifier, we instantly perceive many rounded grains of quartzose sand: we perceive moreover much of the feldspar to be only imperfectly formed, as if congealed when *in transitu*, though the mica has more nearly reached the standard condition which it has in granite. In some of the coarser varieties of this white rock, small distinctly rounded pebbles of quartz are to be seen, giving unequivocal evidence, even to the naked eye, of its being an altered sandstone. Upon inspecting many varieties of this rock, we felt no hesitation in deciding it to have been a coarse silico-argillaceous white sandstone, now almost granitized by extensive metamorphic action. The slope of the steep mountain side is in many places strewed even to its base, with long trains of the angular blocks of this seeming granite fallen from the high crowning cliffs above. Seen in places near the summit of the mountain, the rock presents two or more systems of extensive and very regular joints or planes of cleavage, by which the whole mass is cut into cubical and trapezoidal blocks. This jointed condition, itself so significant of an extensive internal structural change, is a principal cause of the magnitude of the piles of fragments which clothe the slopes of the mountain. It is beheld even more conspicuously in the shattered crests which bound the valley above and below the Willey house, where an almost continuous thick sheet of coarse angular *debris* conceals the stratification except in the craggy precipices near the summits. Those sublimely terrific and desolating *slides* which have occurred here at different times, are therefore primarily attributable to this jointed structure. This has permitted the elements to dislodge the fragments and heap an unusually abundant and heavy *talus* high upon the slopes of the steep hills, where its unstable equilibrium, weakened by saturation from copious rains, has caused great bodies of the rubbish to give way and rush down with destructive impetuosity into and across the bed of the narrow valley beneath.

Generalizing the position and dip of these clearly mechanical but altered strata, on both sides of the gorge of the Saco, we think that there are ample data for inferring the existence of a great anticlinal fold or axis, crossing the valley in a direction nearly N. W. and S. E., as represented by the line $x y$. This axis is plainly indicated on each side of the Gorge by a deep depression in the summit line of the mountain, especially in the crest which overlooks the valley on the western side. At this latter place the situation and bend of the axis line is easily discernible, even from the valley below, in consequence of the contrast of certain dark-colored argillaceous strata, in color and bedding, to the other rocks.

In the flank of the mountain, capped by the highly altered white granitized sandstone already mentioned, we discover on the west side of the Gorge, about one third of a mile below the Notch and within one hundred feet of the road, a thick bed of a light brownish altered shale, imbedded with a nearly vertical dip between strata of the metamorphic sandstone before referred to, as so nearly granitic in its aspect. This shale is replete with fossils of recognizable genera and species, but in the state of casts and mere impressions. The removal of the substance of the fossils from the rock, has probably been the result of filtration and solution, completed previously to that intense heating of the strata by which the more fusible masses were so extensively baked and metamorphosed.

Among the fossils are what *appear* to be *fish-scales,* also a small *Agnostis,* the specimens of which though only impressions, have a strong likeness to the Agnostis latus of our *Levant series,* (Clinton group of New York.) We recognize likewise a *Cytherina,* like C. alta, of the same formations. There are also innumerable minute objects, which are probably the organs of some small crustacean. In addition to these, we recognize among the shells, the Atrypa ferruginea, (nobis,) so characteristic of the *Levant series* in Pennsylvania and Virginia, and a small tumid shell, probably also an Atrypa, identical, we think, with another *Levant* species. Also a *Lingula* like *L. Clintoni.* Some specimens abound in very minute globular bodies, somewhat like the granules of green sand in color, but which may possibly be organic. These and other seemingly organic forms we hope soon to subject to a more thorough examination than we have yet been able to give them.

Though the number of species possessing a sufficiently definite form is very limited, we think we may safely refer them to the *Levant series* of our nomenclature, (embracing the Clinton group of New York.) Some of the forms however bear an analogy to certain species which abound in the higher part of the *Matinal series*, in the *Matinal newer shales*, (Hudson river group,) and we desire therefore to be understood as venturing our opinion of their belonging to the Levant formations, with considerable hesitation. We should mention however that besides the above affinities of the fossils, there are several features about the rock, especially the great abundance of Agnostis and other minute organic forms, which induce us to lean to the conclusion that it is a member of the great Levant series.

This stratum, so remarkably fossiliferous, is only a few yards in width where it is exposed at the locality we have designated, and it there lies with a nearly vertical dip, between masses of highly altered sandstone, possessing, until carefully inspected, a close resemblance to granite. The white feldspathic or granitized sandstone, already described as crowning the top of the hill, belongs probably to one of these including masses; but from the perpendicularity of the dip it is obviously impossible to infer which was originally the superior formation. Near the summit of the ridge, however, the sandstone seems to overlie the shale; but an inversion of the dip here might very naturally exist, and it is necessary therefore to appeal to some other evidence than that of position merely to determine the stratigraphical order of these rocks. As the altered white sandstone in the portions examined, is apparently destitute of organic remains, we have no feature to guide us but its composition and aspect. These are well marked and strongly indicate its identity with the *Levant white sandstone*, (or Shawangunk grit.) To no other formation in the whole Apalachian series, except perhaps the *primal sandstone*, (Potsdam sandstone,) does it bear any near resemblance, and its affinity even to the primal sandstone is rather remote. The shales belonging to the primal rocks contain moreover scarcely any fossils and certainly none of the species here enumerated, and since there is no visible hiatus in the strata indicated by an unconforming dip, this argument may be held to be conclusive. We are therefore disposed to regard the two formations, the white sandstone and the fossiliferous shale, as the equivalents respectively of the *Levant white sandstone* and one of the higher *Levant shales* near the horizon of the fossiliferous iron ore. Upon this view some of the intermediate shales are absent, and when we advert to the distance between the White Mountains and the nearest outcrop of the *Levant series* in New York, this ought not to surprise us. Upon the less probable conjecture that the fossiliferous bed is a portion of the *Matinal shales*, no assumption of a deficiency in the series is required, for the *Levant white sandstone* comes naturally next in the ascending order. The general conclusions to which we are brought by this unexpected discovery of a fossiliferous formation, related evidently to one of the earlier Apalachian periods, are not however in the slightest degree affected by this trivial amount of uncertainty respecting the age of either bed. We proceed therefore to state the inferences deducible from the foregoing facts.

One of the most interesting conclusions to be drawn from the evidence afforded by the above described fossiliferous strata, relates to the geological age of the chain of the White Mountains. These strata present convincing proofs that the region, now occupied by this mountain chain, was overspread by the waters of the ancient Apalachian ocean at an era as late in the Palæozoic ages, as the Matinal, or more probably the Levant periods. Placed as the district is, immediately between the nearly contemporaneous formations of the states of Maine and New Brunswick on the one hand, and Vermont and New York on the other, it fills up an interval in the area of the Apalachian rocks, which hitherto seemed vacant, and suggests strongly that the waters of the *Matinal* or *Levant* eras, extended continuously across at least all northern New England. As it is known that the Apalachian strata abound as far to the N. E. as Nova Scotia, and perhaps Newfoundland, and spread to a great distance north and northwestward in the continent, the prodigious magnitude of the Apalachian sea, at least in its earlier periods, is made apparent. But while these fossiliferous beds of the White Mountains make it probable that the continuity of this sea was unbroken by any land in the position of New Hampshire before the Levant period, they indicate as plainly that some land did emerge after this period had commenced. How long subsequent to the deposition of the earlier Levant strata that portion of the bed of the ocean was uplifted into land, it is not practicable very positively to ascertain, until we are certain of the latest age in which any of the fossiliferous rocks of the White Mountains were produced. That the elevation was before the *Carboniferous period*, which witnessed the final draining of the Apalachian sea, seems manifest enough from two considerations.

It is almost certain, in the first place, that none of the Apalachian strata of the middle or latter ages were deposited within this region; for no traces of the coal rocks nor of the fossiliferous *Post-medial shales*, (Marcellus shales, &c.,) nor any of the red shales referable either to the later *Levant* or the *Ponent* (Catskill group) *periods* have yet been met with: and since these newer palæozoic formations abound both to the S. W. and N. E. we must infer that their absence in this locality is due to a lifting out from the bed of the sea previous to their deposition. Had they been deposited within this area, some remnants of these strata would almost certainly have been preserved from denudation in the close folds or synclinal bends of this contorted district. In the second place, there is abundant evidence in the region of the Hudson valley, where the Levant rocks rest almost horizontally on the upturned edges of the Matinal, that the bed of the Apalachian waters underwent a local disturbance at the close of the Matinal period, and it is equally obvious that the direction of this disturbance, as seen in the course of the axes of elevation and depression, was different from that of the subsequent movement by which all the deposits *at the end* of the Apalachian ages were contorted and upraised. So in like manner we may perceive, in the structure of the White Mountains, the proofs of two distinct intersecting systems of dip, the components of two separate sets of axes or contortions of the crust, indicating two different epochs of elevation. One of these, and apparently the latest, is a N. N. E. and S. S. W. set of anticlinal and synclinal folds; and is therefore probably a part of the general movement which lifted the whole Apalachian or Alleghany chain, and drained away the palæozoic waters; but whether the other accords as nearly in direction and date with the earlier system of the Hudson valley, the epoch of which was either at the close of the Matinal or early in the Levant times, is an important and interesting question which only future research can answer. The most natural inference from all the facts would seem to be, that in the somewhat disturbed period last referred to, when, as geologists are already aware, all the more ancient Apalachian rocks, from the earliest to perhaps the Levant sandstones, suffered a contortion and general uplift in the region which is now the northern part of the Hudson valley, the same disturbance and elevation of the earth's crust extended to the district which is now the White Mountain chain. If we conceive indeed the whole of the wide tract of undulating and in some places mountainous surface, from the upper Hudson and Lake Ontario, eastward to Maine inclusive, and possibly a large territory north of the St. Lawrence, to have emerged from the waters into permanent land, during the close of the Matinal period and the first ages of the Levant, while the still wider spaces to the S. W. and N. E. remained undisturbed, for the reception of later strata, we shall be able to interpret many important facts in the geological structure not only of this ancient district but in that of the neighboring regions.

The hypothesis which supposes that the bed of the Apalachian ocean was violently and extensively agitated by a succession of earthquake movements, at the end of the Matinal and early in the Levant periods, resulting in the conversion of all northern New York and New England, and probably the whole southeastern border of that sea into permanent dry land, supplies us in the first place with an explanation of the unconformable superposition of the Levant upon the Matinal rocks, discovered by one of us in 1837 near the city of Hudson, and visible at a number of other points E. and N. E. of the Catskills. It furnishes moreover a cause for the extremely wide diffusion, and the coarse conglomeritic composition of the early Levant sandstones, amid the pebbles and sand-grains of which, are many fragments obviously derived from the uplifted and broken Matinal and Primal strata. It provides furthermore a physical reason for the marked transition observable in the species, when we ascend from the organic remains of the Matinal to those of the Levant formations. An era of paroxysmal action would be naturally the period of a modification in the conditions and forms of life, for extensive and permanent changes would arise in the bed of the sea, the waters would grow shallow in many places, would deepen in others, their temperature and their currents would alter, and even the proportions of the elements held in chemical solution, which are the very pabulum of the aquatic races, would sustain some change. But perhaps the most interesting application of the hypothesis here referred to, is the explanation it affords of the excessively crystalline or metamorphic condition of the Apalachian deposits in the district supposed to have undergone this ancient elevation. Upon this supposition these districts, embracing nearly all New England and the Atlantic slope of the Middle and Southern states, were the areas of chief movement, while the other portions of the Apalachian sea were but slightly affected. Here therefore the crust underwent the maximum degree of dislocation and of heating, and the newly precipitated surface sediments were rent, brought into contact with the intensely heated veins and dykes of internal molten matter, and baked and probably partially crystallized, while those of the remoter and still submersed tracts were but slightly acted on. As these districts, the southeastern and northeastern parts of the Apalachian basin, were the first to be invaded by igneous action, so they continued, as it would seem, to be the quarter where this action was oftenest repeated, and where at each epoch of disturbance, especially that which witnessed the final drainage of the Apalachian sea, it was greatly the most energetic. The whole structure of the Apalachian chain supports this conclusion; the truth of which is confirmed by the excessively folded and dislocated condition of the strata along this whole belt of country, and the gradation to features of less and less disturbance as we cross the strata westward still further, by the progressive flattening of the anticlinal arches, by the decreasing amount of crystallization in the rocks, and even the increasing quantity of the volatile bitumen in the coal. When we advert to this repetition of igneous action along this chief belt of volcanic force, upon the early elevated Primal and Matinal deposits, we can no longer wonder at their highly metamorphic condition, nor hesitate to impute to such cause any extent of lithological alteration exhibited by portions of the strata, even to the aping of true granite and gneiss.

The suggestion we have here made, that the Primal and Matinal rocks of the White Mountains emerged from the waters in the Levant period, and were elevated into anticlinal and synclinal flexures with a different strike from those of the more extensive crust undulations of the late carboniferous date, offers a natural cause, we think, for the superior elevation of their outcrops in this mountain chain, compared with their height in the Green Mountains and other districts where only one system of axes, upon a large scale, is discernible. As the level of the water is highest at the intersection of two crossing billows, we can understand why in a region of two interfering sets of dips or archings in the strata, such as we see indicated in the great defile of the Saco, there should coexist a series of loftier peaks than are any where else presented in the general mountain chain. The same intersection of axes of different geological dates has probably produced in like manner the very elevated and pyramidal group of mountains between Lake Champlain and Lake Ontario, to which the general name of the Adirondack range is given. The prodigious elevation and insulation of the peaks of the Alps have likewise manifestly originated in the want of coincidence in the great folds or axes, during the successive movements of elevation.

SCIENTIFIC INTELLIGENCE.

I. CHEMISTRY.

1. *On new Magnetic Actions, and on the Magnetic Condition of all Matter;* by MICHAEL FARADAY, Esq., D. C. L., F. R. S., &c. "Experimental Researches in Electricity," 20th series, sect. 26th. (Phil. Mag., Feb. 1846, xxviii, 147.)—The following is the order in which the several divisions of the subject treated of in this section of the author's researches in electricity, succeed one another:—1. Apparatus required. 2. Action of magnets on heavy glass. 3. Action of magnets on other substances acting magnetically on light. 4. Action of magnets on the metals generally. 5. Action of magnets on the magnetic metals and their compounds. 6. Action of magnets on air and gases. 7. General considerations.

In giving an account of the contents of this paper, any attempt to follow the track of the author in the precise order in which he relates the consecutive steps of his progress in this new path of discovery, would fail of accomplishing its object: for, by adhering to such a course, it would scarcely be possible to comprise within the requisite limits of an abstract, the substance of a memoir extending, as the present one does, to so great a length, and of which so large a portion is occupied with minute and circumstantial details of experiments; or to succeed in conveying any clear and distinct idea of the extraordinary law of nature brought to light by the author, and of the important conclusions which he has deduced.

One of the simplest forms of experiment in which the operation of this newly discovered law of magnetic action is manifested, is the following:—A bar of glass, composed of silicated borate of lead, two inches in length and half an inch in width and in thickness, is suspended at its centre by a long thread, formed of several fibres of silk cocoon, so as to turn freely, by the slightest force, in a horizontal plane, and is secured from the agitation of currents of air by being enclosed in a glass jar. The two poles of a powerful electro-magnet are placed one on each side of the glass bar, so that the centre of the bar shall be in the line connecting the poles, which is the line of magnetic force. If, previous to the establishment of the magnetic action, the position of the bar be such that its axis is inclined at half a right angle to that line, then, on completing the circuit of the battery so as to bring the magnetic power into operation, the bar will turn so as to take a position at right angles to the same line; and, if disturbed, will return to that position. A bar of bismuth, substituted for the glass bar, exhibits the same phenomenon, but in a still more marked manner. It is well known that a bar of iron, placed in the same circumstances, takes a position coincident with the direction of the magnetic forces; and therefore at right angles with the position taken by the bar of bismuth subjected to the same influence. These two directions are termed by the author *axial* and *equatorial;* the former being that taken by the iron, the latter that taken by the bismuth.

Thus it appears that different bodies are acted upon by the magnetic forces in two different and opposite modes; and they may accordingly be arranged in two classes: the one, of which iron is the type, constituting those usually denominated *magnetics;* the other, of which bismuth may be taken as the type, obeying a contrary law, and therefore coming under the generic appellation of *diamagnetics.* The author has examined a vast variety of substances, both simple and compound, and in a solid, liquid, or gaseous form, with a view to ascertain their respective places and relative order with reference to this classification. The number of simple bodies which belong to the class of magnetics is extremely limited, consisting only of iron, which possesses the magnetic property in an eminent degree, nickel, cobalt, manganese, chromium, cerium, titanium, palladium, platinum and osmium. All other bodies, when either solid or liquid, are diamagnetic; that is, obey the same law, with regard to magnetic action, as bismuth, but with various degrees of intensity: arsenic is one of those that give the feeblest indications of possessing this property. The following exhibit it in increasing degrees, according to the order in which they are here enumerated; namely, ether, alcohol, gold, water, mercury, flint glass, tin, lead, zinc, antimony, phosphorus, bismuth. On the other hand, no gaseous body of any kind, or in any state of rarefaction or condensation, affords the slightest trace of being affected by magnetic forces. Gases may therefore be considered as occupying the neutral point in the magnetic scale, intermediate between magnetic and diamagnetic bodies.

The magnetic properties of compound bodies depend on those of their elements; and the bodies are rendered either magnetic or diamagnetic according to the predominance of one or other of these conditions among their constituent parts. Thus iron is found to retain its magnetic power when it has entered into combination with other bodies of the diamagnetic class; the two forces acting in opposition to one another, and the resulting effect being only that due to the difference in their power. Hence the oxides and the salts of iron are still in a certain degree magnetic, and the latter even when they are held in solution by water; but the water may be present in such a proportion as that neither shall prevail; and the solution, as far as respects its magnetic properties, will then be exactly neutralized. These saline solutions, prepared of various degrees of strength, also afford a convenient method of comparing the relative degrees of force, both magnetic and diamagnetic, of different bodies, whether solid or fluid, but more especially the latter, as they admit of the body under examination being suspended in another liquid, when its position of equilibrium will indicate which of the two substances has the strongest magnetic power.

In one respect, indeed, the diamagnetic action presents a remarkable contrast with the magnetic; and the difference is not merely one of degree, but of kind. The magnetism of iron and other magnetics is characterized by polarity; that of diamagnetics is devoid of any trace of polarity; the particles of two bodies of the latter class, when jointly under the influence of the magnetic forces, manifest towards each other no action whatever, either of attraction or repulsion. It has long been known that the magnetism of iron is impaired by heat; and it has been generally believed that a certain degree of heat destroys it entirely. The author finds, however, that this opinion is not correct; for he shows that, by applying more powerful tests than those which had been formerly confided in, iron, nickel and cobalt, however high their temperature may be raised, still retain a certain amount of magnetic power, of the same character as that which they ordinarily possess. From the different temperatures at which the magnetic metals appear to lose their peculiar power, it had formerly been surmised by the author, that all the metals would probably be found to possess the same character of magnetism, if their temperature could be lowered sufficiently; but the results of the present investigation have convinced him that this is not the case, for bismuth, tin, &c. are in a condition very different from that of heated iron, nickel or cobalt.

The magnetic phenomena presented by copper and a few other metals are of a peculiar character, differing exceedingly from those exhibited by either iron or bismuth, in consequence of their being complicated with other agencies, arising from the gradual acquisition and loss of magnetic power by the iron core of the electro-magnet, the great conducting power of copper for electric currents, and its susceptibility of being acted upon by induced currents of magneto-electricity, as described by the author in the first and second series of these researches. The resulting phenomena are to all appearance exceedingly singular and anomalous, and would seem to be explicable only on the principles referred to by the author.

Pursuing his inductive inquiries with a view to discover the primary law of magnetic action from which the general phenomena result, the author noticed the modifications produced by different forms given to the bodies subjected to experiment. In order that these bodies may set either axially or equatorially, it is necessary that their section, with reference to the plane of revolution, be of an elongated shape: when in the form of a cube or sphere, they have no disposition to turn in any direction: but the whole mass, if magnetic, is attracted towards either magnetic pole; if diamagnetic, is repelled from them. Substances divided into minute fragments, or reduced to a fine powder, obey the same law as the aggregate masses, moving in lines which may be termed *diamagnetic curves*, in contradistinction to the ordinary magnetic curves, which they every where intersect at right angles. These movements may be beautifully seen by sprinkling bismuth in very fine powder on paper, and tapping on the paper while subjected to the action of a magnet.

The whole of these facts, when carefully considered, are resolvable, by induction, into the general and simple law, that while every particle of a magnetic body is attracted, every particle of a diamagnetic body is repelled, by either pole of a magnet. These forces continue to be exerted as long as the magnetic power is sustained, and immediately cease on the cessation of that power. Thus do these two modes of action stand in the same general antithetical relation to one another as the positive and negative conditions of electricity, the northern and southern polarities of ordinary magnetism, or the lines of electric and of magnetic force in magneto-electricity. Of these phenomena, the diamagnetic are the most important, from their extending largely, and in a new direction, that character of duality which the magnetic force was already known, in a certain degree, to possess. All matter, indeed, appears to be subject to the magnetic force as universally as it is to the gravitating, the electric, the cohesive and the chemical forces. Small as the magnetic force appears to be in the limited field of our experiments, yet when estimated by its dynamic effects on masses of matter, it is found to be vastly more energetic than even the mighty power of gravitation, which binds together the whole universe: and there can be no doubt that it acts a most important part in nature, and conduces to some great purpose of utility to the system of the earth and of its inhabitants.

Towards the conclusion of the paper, the author enters on theoretical considerations suggested to him by the facts thus brought to light. An explanation of all the motions and other dynamic phenomena consequent on the action of magnets on diamagnetic bodies, might, he thinks, be offered on the supposition that magnetic induction causes in them a state the reverse of that which it produces in magnetic matter: that is, if a particle of each kind of matter were placed in the magnetic field, both would become magnetic, and each would have its axis parallel to the resultant of magnetic force passing through it; but the particle of magnetic matter would have its north and south poles opposite to, or facing the contrary poles of the inducing magnet; whereas, with the diamagnetic particles, the reverse would obtain; and hence there would result, in the one substance, approximation; in the other, recession. On Ampère's theory, this view would be equivalent to the supposition that, as currents are induced in iron and magnetics, parallel to those existing in the inducing magnet or battery wire, so, in bismuth and other diamagnetics, the currents induced are in the contrary direction. As far as experiment yet bears upon such a notion, the inductive effects on masses of magnetic and diamagnetic metals are the same.

2. *Researches on the Relations of Light and Magnetism;* by M. Faraday, Royal Institution, Jan. 23—(Athenæum, No. 953, Jan. 31, 1846, p. 126.)—We shall confine ourselves to the method by which Prof. Faraday exhibited the great fact of his researches—*the rotation of a ray of light by magnetic force.* The well known oxy-hydrogen light of Drummond supplied the ray. This light was so directed by an arrangement furnished by Mr. Darker, as to make distinctly visible, over the whole theatre, all the phenomena of circular polarization which were required to illustrate Prof. Faraday's newly discovered principle. A beam of common light was shown to be separable into two distinct rays of polarized light; and the properties of these, and their relation to each other, were repeatedly demonstrated to the spectators. Such being the subject of his operations, Prof. Faraday next exhibited the nature and extent of the force employed to accomplish his results. That force is magnetism derived from an electro-magnet of immense size and power. The magnet used was a half link of the former East India moorings, surrounded by several coils of thick copper wire, and the source of electric power was Grove's battery, about

twenty cells of which were employed on this night. To give an idea of the force of this electro-magnet, Prof. Faraday mentioned that once, while he was at work in the laboratory, an iron candlestick which happened to be standing on the table near its poles, instantly flew to them, attracted with such violence as to displace or break every thing in its way. The great experiment of the evening was then successfully tried. A prism of heavy glass was so adjusted between the poles of the magnet, as to receive the oxy-hydrogen light after it had been polarized, and before it was depolarized by Nicholl's eye-piece. The following facts, demonstrating the magnetism of light, were then exhibited:

1. As to the *rotation* of the ray.—A polarized ray, having been extinguished by the depolarizing plate, was instantaneously restored when the magnetic current was sent through the prism through which the ray was transmitted: and conversely, the polarized ray, when, by the common adjustments of the plate, it had been made visible, was extinguished by the force of the current.

2. As to the relations of this electro-magnetic power to other laws of polarized light.—The rotation having been established, it was shown, (*a.*) That the direction of the rotation was absolutely dependent on that of the magnetic force. (*b.*) That, while in common circular polarization, the ray of light always rotates in the same direction *with regard to the observer*, (to whatever part of the medium his view may be directed,) it is very different in the state of the ray induced by this new force. When brought under the influence of the magnetic current, polarized rays always rotate in a constant direction with respect, *not to the observer*, *but to the plane of the magnetic curves.*

Prof. Faraday concludes, by throwing out some general notions as to the possible development of these researches in the line of future investigations. It did not seem impossible to him, that the sun's rays might be found to originate the magnetic force of the earth, and the air and water of our planet might be proved to be the diamagnetic media in which this condition of the force was eliminated.

M. Pouillet has repeated the experiments of Faraday, and communicated a report to the Academy of Sciences of Paris, (L'Institut, No. 630.) He is of the opinion that the phenomena are due to action on the transparent medium, or upon the forces which govern its molecules, and not on the luminous ray itself.

3. *Sound from vibration of soft iron, produced by a galvanic current*, (L'Institut, No. 634, Feb. 1846, p. 65.)—This singular phenomenon, discovered by Mr. Page, and verified by M. Marrian, has been studied since by de la Rive and Matteucci. These authors have attributed the

sound to a vibration in the interior of the iron bar, or a new arrangement of the molecules; but they are not agreed on the mode of vibration; de la Rive believing it to be transversal, and Matteucci endeavoring to prove it to be longitudinal. M. Wertheim, after a series of experiments, has ascertained that there are at times, both longitudinal and transverse vibrations. His experiments were made with a bar of iron two meters long and one centimeter thick, which was fixed at middle in a horizontal position, and had each half enclosed in a large glass tube, which tubes were wound with a spiral of copper wire. A coil of copper wire (1336 metres in length, and 19 centimeters in its inner diameter) was afterwards substituted for the two helices, and placed with its axis coincident with the axis of the bar. On completing the circuit, the longitudinal sound, although feeble, could be distinguished, and the bar was a little lengthened in the direction of the axis. When the axis of the coil was one side of the centre, the bar was attracted and bent toward it, and resumed its first position only on the cessation of the current. Thus by varying the position of the coil, the bar could be bent horizontally or vertically, or in an intermediate position, and the flexure amounted to several millemeters. In opposition to the deduction of Guillemin, from his experiments, M. Wertheim has shown that the elasticity of iron is diminished by magnetization. He is preparing to ascertain by direct micrometrical investigation, the amount of elongation which the iron bar is believed by him to undergo.

M. Guillemin, in the experiments alluded to, found that a bar of iron wound with a spiral of copper wire, supported at one end and bent by a weight suspended from the other, sensibly straightened itself, on the passage of a magnetic current through the copper wire.

4. *Electric excitement of paper;* by Rev. H. G. O. Dwight, (communicated.)—It is well known that friction will excite electricity in a sheet of paper, especially if it be thoroughly dry. This is well shown by placing the paper on a warm stone, for a moment, when a single passing of the palm of the hand will produce electric excitement. On raising the paper carefully from the stone, sparks may be obtained from different parts of it by the knuckle. If a piece of tin plate be placed on the paper arranged on the stone, and pressed down, on raising the whole carefully, a strong spark is procured; and if it be returned to the stone, and the plate again pressed strongly upon the paper, another spark is given out on again raising it.

If the sheet of paper with the tin plate mentioned above, be charged as just explained, and then be removed carefully, and placed on a sheet of tinfoil upon the top of an insulated stool, and pressed down with a finger at the centre,—on raising it, a strong spark will be obtained from the tinfoil, and another from the lower surface of the tin plate through the paper. This simple electrical machine may be again charged by returning the paper to the stone, and pressing the tin plate down upon it with the hand.

5. *On a New Process for obtaining pure Chlorine Gas;* by Profs. R. E. Rogers, and W. B. Rogers, of the University of Virginia, (communicated by the authors.)—This process is founded on the powerful oxidating action of chromic acid, especially when liberated in a solution, and consists in causing a reaction between hydrochloric acid and this substance, in which the chlorine of the former is set free. Our mode of proceeding is as follows.

To 1 part of powdered bichromate of potassa, in a small retort or flask, we add 6 parts of hydrochloric acid, of specific gravity about 1·16, and apply a gentle lamp heat for a few seconds, so as to bring about a brisk reaction. The chlorine is now rapidly evolved, and continues to be disengaged as fast as is convenient, without requiring any further application of the lamp.

Referring to the composition of the bichromate of potassa and of hydrochloric acid, it will be seen that *one equivalent of bichromate of potassa and seven of hydrochloric acid, are capable of evolving three equivalents of chlorine*, at the same time giving rise to one equivalent of the sesquichloride of chromium, one of the chloride of potassium, and seven of water.

In order to ascertain how near we might approach to the equivalent quantity of chlorine above deduced, we resorted to the following method. Knowing that a strong solution of chloride of sodium is much less absorbent of the gas than ordinary water, we prepared a quantity of saturated brine, through which we passed chlorine, until the liquid appeared to be fully charged. With this we filled a tall graduated vessel, designed to receive the gas, and a porcelain bowl, which served as a pneumatic trough, and having placed 4 grammes of the bichromate with an excess of hydrochloric acid in a small retort, we passed the gas as it was evolved through the chlorous saline solution into the narrow graduated jar. After urging the process until the action entirely ceased, and no further gas escaped, we measured the resulting gas with the usual precautions, at 60°. Its volume was found to be 54·5 cubic inches. On repeating the experiment with the same amount of bichromate and acid, and with the same brine, we obtained in the second trial 55·5 cubic inches, and in the third 56·2 cubic inches of the gas, the increase being evidently due to the diminished absorption arising from the more complete saturation of the liquid with chlorine.

Taking 76·5 grains as the weight of 100 cubic inches of chlorine, at 60° Fahr., the volume due to the entire decomposition of 4 grammes of bichromate of potassa, is 57·3 cubic inches. It thus appears that with proper precaution, this process may be made to yield $\frac{56}{57}$ths, or nearly the whole theoretical amount of the gas.

6. *Radiant Heat*, (L'Institut, No. 629, Jan. 21, 1846, p. 22.)—M. Knoblauch, of the Academy of Sciences of Berlin, has found by experiment, that the diathermal modifications which heat undergoes by reflexion differ according to the source of the heat; that (1) these modifications are quite decided with heat from an argand lamp; (2) they are much less for heat from incandescent platina; (3) they are still less for the heat from an alcoholic lamp; and that (4) none whatever can be distinguished for heat from a cylinder of iron heated between 68° and 320° F.

These modifications depend either on a transformation of the calorific rays, rendering them more or less transmissible across diathermal substances; or they result from an elective absorption by the reflecting surfaces, a view rendered probable by the experiments of Powell and Melloni. Experiment has shown that carmine facilitates the passage of heat across calc spar. If this effect is owing to its absorbing those rays which traverse calc spar with difficulty, it ought to reflect as much less perfectly the heat from a source which affords those rays that traverse the spar with difficulty. Now, it is found that heat from the cylinder of iron traverses calc spar much less completely than that from an argand lamp; consequently carmine, in case of an elective absorption, ought to reflect the heat of the iron less perfectly than that of the lamp. This is fully confirmed by experiment.

7. *Milk of the Milk tree*, (L'arbre de vaches, Galactodendrum utile.)—An analysis of this vegetable milk, afforded M. Heintz the following result: water 57·3, vegetable albumen 0·4, a species of wax (having the formula $C^{35} H^{66} O^{8}$) 5·8, a resin soluble in cold or boiling alcohol (corresponding to the formula $C^{35} H^{58} O^{2}$) 31·4, gum and a kind of sugar 4·7, bases resisting the action of heat, such as magnesia, soda, traces of potash and lime combined with phosphoric acid, and an organic acid undetermined 0·4=100. This agrees nearly with the analyses of MM. Boussingault and Mariano; but differs so much from that by M. Marchand, that M. Heintz suspects he may have examined the milk of another species of plant.

8. *Artificial Asbestus*, (Proceedings Phil. Soc. of Glasgow.)—A specimen of this substance was found in a blast furnace, imbedded in the mass of matter which had collected at the bottom of the furnace, in the course of two years and a half. It was in a cavity about eight inches below the level on which the liquid metal rested, and was interspersed with beautiful crystals of titanium. It has the general character of asbestus, forming small masses, consisting of delicate filaments or fibres easily separable. The fibres are flexible, though not so much so as common asbestus; they fuse with difficulty, and are not attacked by sulphuric, nitric or muriatic acid.

9. *Artificial Aventurine;* by MM. Fremy and Clemandat, (L'Institut, No. 624.)—The process for making aventurine has been hitherto a secret with the glass establishments at Venice. It has been known that the peculiarities of it are due to disseminated crystals of copper. M. Fremy, after various experiments, has found that it may be imitated by mixing with glass, and heating for some hours, a portion of protoxyd of copper and protoxyd of iron. Reaction deoxydizes the copper and leaves it in delicate crystalline points; while the iron becomes a peroxyd, and but slightly tinges the glass with yellow. The specimens thus far obtained have a slight opacity, which makes them inferior to the Venice aventurine, although similar in other respects.

10. *Specular Iron artificially produced,* (L'Institut, No. 634, Feb. 1846, p. 72.)—The theory for the formation of crystals of specular iron in the fissures of volcanic rocks through the agency of chlorine, proposed and explained by Mitscherlich, has been lately confirmed by a singular phenomenon at the salt mines of Wieliczka. The supporting wood-work through these vast mines was some time since consumed by fire, and the iron tubes suffered more or less. After the fire, some specimens of saliferous clay were obtained from the parts which had been exposed to the heat, which were traversed with fissures covered with implanted crystals of specular iron.

11. *Bromide and Chloride of Silver in ancient coins,* (L'Institut, No. 634, Feb. 1846, p. 72.)—M. Bruel of Hanover states, as the result of some analyses by him of ancient coins, that they contained bromide and chloride of silver. These substances were found to occur in the greatest quantity in Greek and Saxon coins of the thirteenth century, but they were detected also in Roman coins. M. Bruel suggests that these ingredients may not have existed in the original coin, but were received from without while buried.

II. Mineralogy and Geology.

1. *On certain Pseudomorphous Crystals of Quartz;* by R. W. Fox, (Jameson's Jour. Jan. 1846, p. 115.)—Crystals of quartz are stated by Mr. Fox to have been found at the Consolidated mines, in a copper vein, which contained regular octahedral pseudomorphous crystals of quartz, and others which enclosed a considerable quantity of liquid. In two of them, common salt was detected, though but slightly saline to the taste. The liquid of others was acrid and contained sulphuric acid, iron, muriatic acid, and lime.

Many of these pseudomorphs were more than an inch in diameter, and were partly or entirely filled with crystalline quartz; while others were empty, or contained more or less numerous fragments of disintegrated fluor. Nearly a hundred such fragments were taken from one of the crystals; and all appeared to *have been corroded as by some solvent.* This solvent must have reached the fluor after the quartz crystals were formed about them, and the resulting solution passed off at the same time. Some contained translucent fragments of carbonate of iron along with the fluor.

The specimens of quartz to which the crystals were attached consisted of successive layers of different colors, and appeared to have been formed by depositions at distinct intervals. At another time, an entire change of condition must have occurred in the vein, in which octahedral crystals of fluor were formed on the quartz. Again silex was deposited on the fluor; and then fluor again upon the quartz. These processes appear from some of the crystals to have been several times repeated, and then came a coating of silex on the fluor, apparently in many successive depositions.

Mr. Fox supposes that these changes have taken place through the action of steam, which may exist in fissures below the water at great depths, from the agency of internal heat; and the alternate depositions may have proceeded from the struggle which would take place between the steam and water above, the one encroaching at intervals on the other. These views are thus presented:—

I have, on former occasions, alluded to various causes which would produce circulation in the subterranean waters, such as the opening or closing of any portions of fissures; the ascent of warm, and the descent of cooler currents of water, in consequence of the differences in their specific gravities; or in some instances, by the pressure of sea water acting on the fresh. Nearly two years ago, I stated in this room, my views in reference to the operation of this latter cause on land springs; and at the same time, I attempted to show the possibility, not to say probability, of steam existing in fissures *below* the water at a very great depth. I may, perhaps, be permitted to refer again to this subject, because it appears to me to be one of some interest. I then took it for granted that the temperature of the earth increases, in some proportion to the increase of the depth below its surface; and that if the ratio be taken at 1° Fah. for every 48 feet, as found in our deep mines; and if Le Roche's data for calculating the elastic force and density of steam be adopted, the forces of steam and of water pressure would balance each other at rather more than nine miles deep, each being equal to the pressure of more than 1400 atmospheres. The density of the steam would there be about one-fourth that of water at 60° Fah., and its temperature above 1050° Fah. But the temperature may probably not increase so rapidly as this at great depths, and the equilibrium in the pressures of the column of water and of steam, may occur much further below the surface, where the density of steam, under an augmented pressure of water, would, of course, be still greater. However this may be, it would seem that, under any probable circumstances, in regard to the ratio of increase in the earth's temperature, the increase in the pressure of the lengthened column of water would not keep pace with the rapidly increasing tendency of the water in descending into more heated parts of the earth to expand into steam, the elasticity of which, at very high temperatures, when confined and in contact with water, is greatly augmented by very small increments of sensible heat.

No water could long remain unchanged into steam below the line of division between them, and there the steam would be denser than at any deeper station, for it would be continually diminishing in density, in descending further from the augmentation of the temperature of the earth; because the *expanding* influence of the increasing heat would much exceed the *condensing* influence of the extended column of steam, added to that of the nearly constant column of water.

The line of demarcation between the water and steam would, doubtless, conform in some degree to the inequalities of the surface. It may be difficult, at first, to conceive the steam capable of supporting the water, or rather of existing permanently under it; but this difficulty will, I think, be obviated by the consideration that the points of contact may be, for the most part, in very narrow fissures, or mere cracks in the rocks, and that the water, being greatly heated, may be much less than *four times* the density of the steam in immediate contact with it. A continual struggle would, no doubt, exist between the water and steam under such circumstances, so that, in many places, they would alternately encroach beyond the line of demarcation; but as the checks on both would increase in proportion to the extent of their encroachments, from the diminution of the temperature above, and its augmentation below, such encroachments would probably not be very extensive or of long duration under ordinary circumstances. Suppose a temporary encroachment of the water on the limits of the steam to occur at one point; the steam would probably encroach on the water at another at the same time, and then reactions taking place, the effects would be reversed. Thus assuming, what indeed would appear to follow from *admitted data as necessary consequences*, steam would not only exist below the water, but such oscillations would tend to give motion and activity to the water in the neighboring fissures, causing it to circulate in the earth more or less freely and extensively according to circumstances. In volcanic districts, where the heat may be great at comparatively small depths, analogous phenomena sometimes occur at the surface, which are probably caused by the action and reaction of steam and water. Amongst these may be included the intermitting Geyser springs in Iceland, as well as some of the mud volcanoes found in Sicily, and in Asia and America.

2. *Petrified Forest near Cairo;* (Athenæum, Jan. 1846, p. 130.)—The following particulars are from an account given by Dr. Buist, of Bombay, in explanation of some specimens of silicified wood presented by him to the Literary Society of St. Andrews:—"The specimens consisted of about forty-five pieces of wood;—trunks, roots, knots and branches, from three inches to three feet in length; some were exhibited sliced and transparent, showing the sap vessels and the medullary rays; some cut into bracelets and brooches. In explaining the peculiarities of these, Dr. Buist stated that few things were more remarkable—few less noticed (considering how worthy it was of examination,) than the petrified forest near Cairo. From the city you proceeded, by the Caliphs' Tombs, to the southeast. Passing for five miles through an arid valley, through which a river torrent appeared to have flowed, skirted on both sides by low, brown, rocky ridges, the traveller turns suddenly off to the right, and beyond the first range of sand-hills, finds, spreading far as the eye can reach, a vast expanse of rolling hillocks, covered with prostrate trees. At first sight these wear exactly the aspect of rotten wood dug out from a Scottish or Irish peat-bog. The color and the amount of decay seem the same. They are lying in all positions and directions on the surface of the burning sand—some forty or fifty feet in length, and one or two feet in thickness; not continuous or entire, but in a line broken across, left in their places like sawn trunks. On touching them, instead of proving mouldering and decayed, they turn out to be hard and sharp as flints. They ring like cast-iron, strike fire with steel, and scratch glass. The sap-vessels and medullary rays—the very bark and marks of worms and insects, and even the spiral vessels, remain entire; the minutest fibres of the vegetable structure are discernible by the microscope. Here you have the carbon—the most indestructible matter known to us—entirely withdrawn, and substituted in its place a mass of silica—a matter insoluble by any ordinary agent, and at any common heat. Yet so tranquilly has the exchange been accomplished, that not one atom has been disturbed; the finest tissues remain entire—the most delicate arrangements uninterfered with. The limits of the petrified forest are unknown: it probably extends over an area of many hundreds, perhaps thousands of miles. It has never been described with any care, and, extraordinary as it is, has excited very little attention. The trees are scattered loosely and at intervals over the desert all the way from Cairo to Suez, a distance of 86 miles. No theory of their silicification or their appearance where they are found, has ever been attempted. The late Dr. Malcolmson found fragments of the wood imbedded in the conglomerate which contains the Egyptian jaspers, and threw it out as possible that they and the gravel of the Desert, consisting almost entirely of jas-

pers, might possibly be the result of abrasion or denudation. This threw the difficulty only one step further back; besides this, that the appearance of the forest is at variance with the theory. No agates or gravel appeared around; the trees seemed to have been petrified as they lay; they looked 'like a forest felled by mighty winds.' A further mystery was this: they lay on the surface of bare drift sand and gravel, and reposing on limestone rocks of the most recent tertiary formation—the texture and color of the imbedded oyster shells were as fresh and pure as if brought not six weeks from the sea."

3. *Cuchullin Hills in Skye.*—The Cuchullin Hills are described by Prof. FORBES, (Jameson's Jour., Jan. 1846, p. 76,) as consisting largely of hypersthene rock, which forms a vast bed, and passes insensibly into one or other of the varieties of trap rocks; and this rock is intersected by numerous veins of claystone, of a dull gray color. The smoothing or planing of the rocks in some places, and the regular furrowings, parallel and strongly marked, which occur on some high vertical cliffs, and rise against opposing promontories, or channel the trough of the valley, are described as very similar to what he had before shown to be a necessary result of glacier action: and to this cause, Prof. Forbes is disposed to refer them. The Cuchullin range is remarkable for its fantastic outline, and is compared to the granite mountains of Dauphiné; and "one part in particular resembles the Montagne de la Grave, aptly likened by M. Elie de Beaumont, to a gigantic nut-cracker, menacing heaven with its open jaws."

4. *Gradual rise of Newfoundland above the sea.* (Jameson's Jour. Jan. 1846, p. 206.)—It is a fact worthy of notice, that the whole of the land in and about the neighborhood of Conception Bay, very probably the whole island, is rising out of the ocean at a rate which promises, at no very distant day, materially to affect, if not to render useless, many of the best harbors we have now on the coast. At Port-de-Grave a series of observations have been made, which undeniably prove the rapid displacement of the sea-level in the vicinity. Several large flat rocks, over which schooners might pass some thirty or forty years ago with the greatest facility, are now approaching the surface, the water being scarcely navigable for a skiff. At a place called the Cosh, at the head of Bay Roberts, upwards of a mile from the sea-shore, and at several feet above its level, covered with five or six feet of vegetable mould, there is a perfect beach, the stones being rounded, of a moderate size, and in all respects similar to those now found in the adjacent land-washes.—(From the Newfoundland Times.)

5. *Cataract Cave, Schoharie*, (from a published account, communicated by A. EGGLESTON.)—The Cataract cave was first opened about two years since, by a young man of the name of Howe. The opening when

first noticed, was but little larger than a man's arm; but after arduous labor for some hours, he succeeded in making his way into a passage where he could stand erect, and continuing on, numerous chambers were discovered, of great extent and beauty. The main avenue has been since examined to a distance of seven miles. One of the innermost rooms, (six miles from the entrance,) which has been named the *Rotunda*, is 30 or 40 feet in diameter, and is said to be 500 feet in height. Beyond this there was another rotunda about 12 feet in diameter, and several hundred feet high. The chambers are splendidly arrayed in stalactites and stalagmites, many of which are of gigantic dimensions. Thousands of bat's bones covered the bottom in some places, and many were imbedded in the stalagmite. About a mile from the entrance, and half a mile from the main avenue, there is a fall of water, of great magnitude, whose roaring in these subterraneous recesses, has been compared to Niagara; the cave is named, from this fall, the Cataract Cave. The rock in which it occurs is limestone.

6. *Geological Survey of Vermont.*—Arrangements have been made for the active prosecution of the field labor of this survey the ensuing season, under the charge of Prof. Adams, whose first report has already been announced by us. Mr. D. Olmsted, Jr., an expert mineralogist and good chemist, attached to the laboratory of Yale College, has been associated with Prof. Adams in the survey. Vermont abounds in rich architectural marbles of many varieties, and other sources of mineral wealth, but their full value cannot be estimated until they have been ably developed by a geological and mineralogical survey.

A fresh scientific interest is now shed on the explorations of this state, since Prof. H. D. Rogers (see his paper at p. 411 of this volume) has demonstrated that fossils exist in the White Mountain strata, which have, almost by common consent, been hitherto looked on as among the oldest *non-fossiliferous* rocks in America, and fully entitled to the epithet of *primary.* We have before us the first essay toward a colored geological map of the state of Vermont, made up from the labors of the past year, with the aid of what has been already determined by Prest. Hitchcock and others. It is interesting to observe from it, the general conformity of trend in the great formations of this section, to those of Massachusetts and Connecticut.

7. *Stigmaria.*—Another instance of the occurrence of Stigmaria on the roots of Sigillaria, has lately been brought under the notice of the Geological Society of London, by Mr. Dawson. In the Pictou coal-field in Nova Scotia, Sigillaria and Stigmaria are abundant; and one large erect trunk of Sigillaria was discovered with roots extending into the bed of under-clay, and these roots were decided Stigmaria; specimens were laid before the Society.

8. *Pterodactyl in the English Chalk.*—Portions of the jaws with teeth, and of several characteristic bones of the extremities of a Pterodactyl, have recently been discovered in the chalk of Kent, England, in a locality that has furnished the large bones which have hitherto been taken for those of a bird as large as an Albatross, but which probably belong to a flying reptile.

III. ZOOLOGY.

1. *On the Formation of Cells;* by M. COSTE, (Ann. Mag. Nat. Hist., xvii, p. 94, from Comptes Rendus, Dec. 22, 1845.)*—The most appropriate examples for supplying the necessary means for resolving the difficult problem of the formation of cells, should be found in those parts where the matter undergoes that primary elaboration which prepares the materials of the new individual. Hence the bases for its solution must be sought in the metamorphoses of the *vitellus*, and we there find the facts developed in so characteristic and evident a manner, that they may be verified by any one. But, before showing how it is that the amorphous matter assumes the cellular form, there is another condition of that matter, the history of which I shall rapidly trace, and with which it is not less important to be acquainted. I allude to that progressive subdivision by means of which it is employed for the production of organic spheres, which must be considered hereafter as special elements of the living tissues. We shall proceed then, first, to study the mode of generation of these spheres in the *vitellus* of Mammalia, subsequently tracing it wherever it occurs. When, in Mammalia, the seminal fluid has passed through the uterus and reached the Fallopian tubes so as to envelope the ovum with its moving molecules, in proportion as the molecules penetrate its substance, we see the yolk undergo the primary modifications which are about to induce the organization of the germ. It commences by becoming concentrated into a smaller volume, and forming itself into a granular globe so perfectly spherical and correctly outlined, that all the grains of which this globe is composed, and which are united together by means of a viscid diaphanous fluid, are apparently retained in the general form which their assemblage represents, by a delicate layer of the same fluid, which appears at the periphery as the representative of an enveloping membrane. But if, after having sufficiently guarded against optical illusions, we endeavor to develope the reality of the appearances which obscure it, we soon recognize that such a membrane does not exist, and that those observers, as for instance Barry, who have admitted its existence, have not pursued their

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* This paper is a continuation of M. Coste's researches, an account of which is given at p. 281 of the present volume.—*Eds. Am. Jour.*

examination with sufficient care. Their error here evidently arises from their having considered the superficial part of the viscid matter which retains the granulations mingled in its own substance as an enveloping membrane. This matter is in fact merely lodged in the interstices of the granulations which it agglutinates, and which it separates so regularly that it appears at first sight to form a wall at the periphery of the *vitellus*, the outline of which appears more distinctly delineated in proportion as its transparence contrasts with the opacity of the granulations which it bounds. But, I repeat, this is an illusion which an attentive analysis corrects, and on this point I have sufficiently repeated my observations to have a well-founded conviction.

The *vitellus* is not then, as has been supposed, a vesicle or cell filled with granules, but simply a granular homogeneous sphere, the whole of the grains of which are kept agglutinated by a diaphanous interstitial matter, the retraction of which matter gives the whole mass the somewhat geometric regularity which it assumes.

Soon (a few hours are sufficient for the accomplishment of this phenomenon) the vitelline sphere divides it into two nearly equal parts, each of which, immediately rendered spherical in form by the centripetal retraction of the viscosity which retains its granulations in union, presents the same aspect and the same composition as the whole from which it emanates.

This primary division is scarcely accomplished before the two secondary granular spheres which are thus formed by a primary division of the *vitellus* become in their turn the seat of a similar division, and the same phenomenon being repeated during a certain time upon each new segment, the *vitellus* is finally resolved into a considerable number of granular spheres of a progressively diminishing volume, but always of the same nature. However Reichert, who has made some special researches upon the division of the *vitellus* of the Batrachia, believes he has observed that each segment is a true cell possessing an enveloping membrane and granular contents. According to him, the phenomenon of the division of the yolk would then have a totally different signification to that which we have given, and would essentially be nothing more than an illusion produced by the liberation of the preexisting vesicles which were inclosed one within another. The *vitellus*, in his view, would at first represent a mother-cell, the wall of which, when ultimately absorbed, would expose to view two inclosed vesicles which form its contents; these two vesicles having thus become free would be dissolved in their turn, and each of them would allow two other vesicles to escape, which would produce an appearance of a division of the yolk into four segments, and so on, until the completion of this illusory division arrived. But although this hypothesis appears to explain a phenomenon until then but little understood, and to corroborate the theory of the exclusive intervention of the cells for the formation of the tissues, it does not follow that we must accept it without examination, and solely from its being reconcilable with an accredited system. I have therefore examined the question with all that care which its importance demands, and, after the most minute researches, I am perfectly convinced that the segments of the *vitellus* or the granular spheres are not real cells. Consequently Barry and Bergmann were deceived when they admitted the contrary.

When the subdivision of the *vitellus* is completed, a process ensues in each of the granular spheres resulting from this division which converts them into true cells. But before arriving at this degree of organization, as we have seen, the living matter had assumed regular forms, and in each vitelline sphere had acquired a generating activity which becomes a powerful cause of multiplication.

There is then a distinct organic form, which may be considered as a primary act of individualization, or a primary manifestation of life, between the amorphous state of this matter and its actual application to the formation of the cellular walls. This primary act, or this primary manifestation, has for its object the formation of granular spheres, which, without being bounded by an enveloping membrane, have already a true existence, are true living individuals, inasmuch as they enjoy the faculty of reproduction, and in multiplying they become the active elements of the organism, and contribute to the formation of the tissues of which the organism is composed.

For my own part, I am unacquainted with anything which is more curious to observe than this progressive duplication of living spheres, reproducing in each secondary segment the reduced but invariable image of the primary vitelline sphere. And in proportion as we witness the realization of this remarkable phenomenon, we are as it were involuntary led to seek, in the material of the substance which is doubled, some arrangement which may explain a metamorphosis, the cause of which cannot be clearly found elsewhere.

In fact, a more attentive examination soon shows that in the centre of each vitelline sphere there exists a diaphanous homogeneous globule having a fatty aspect, and which cannot be compared to anything better than a drop of oil. Seeing that this globe appears in so constant a manner, we inquire if the division of the *vitellus* cannot be attributed to its influence. But in order to solve this problem, what passes in this same vitellus prior to its division, and when it consequently appears as a simple sphere, should be examined.

We then see that the fatty or oleaginous globe, hidden in the midst of the granulations of the primitive sphere, there undergoes a contraction which divides it into two segments or distinct globules, and each of these segments seems to become a centre, which tends to envelope itself in a portion of the surrounding granulations, separating them from cells which are entangled by its fellow. We should say, in short, that the vitelline sphere, excited simultaneously by two centres of action, yields to each of these centres half the substance of which it is composed, and thus divides into two segments which are immediately rendered spherical; each segment of the vitelline sphere, being furnished with the oleaginous globule which has excited the separation, then becomes in its turn the seat of a similar process, and the division of its central globule induces that of the secondary sphere which contains it. This is the manner in which the phenomenon of the multiplication of the vitelline spheres ensues; but this phenomenon, which we have considered as the result of a double influence simultaneously exerted upon each of the segments of the *vitellus* by the division of the fatty globe which occupies its centre,—this phenomenon, I say, seems to refer to a still deeper cause, and so to speak, to be nothing more than the external and consecutive repetition of a more intimate and previously completed process. In fact, each central fatty globule contains in its interior a much smaller generating globule, and which appears, in regard to the fatty globule, to play the same part as the fatty globe fulfils with regard to the vitelline spheres by which it is enveloped. So that if we review the whole of the facts which the *vitellus* presents during the transformations which we have described, we find that the elements to which these metamorphoses give rise are derived from one another in a continued series, and are all the result of a triple envelopment.

This envelopment commences by the appearance of a primordial globule within the vitelline spheres; the globule then becomes a centre, around which the fatty globule is condensed; the latter subsequently resolves itself into two distinct fragments; and these fragments, enveloping themselves with the vitelline matter, produce the granular spheres, the mode of multiplication of which I have previously described.

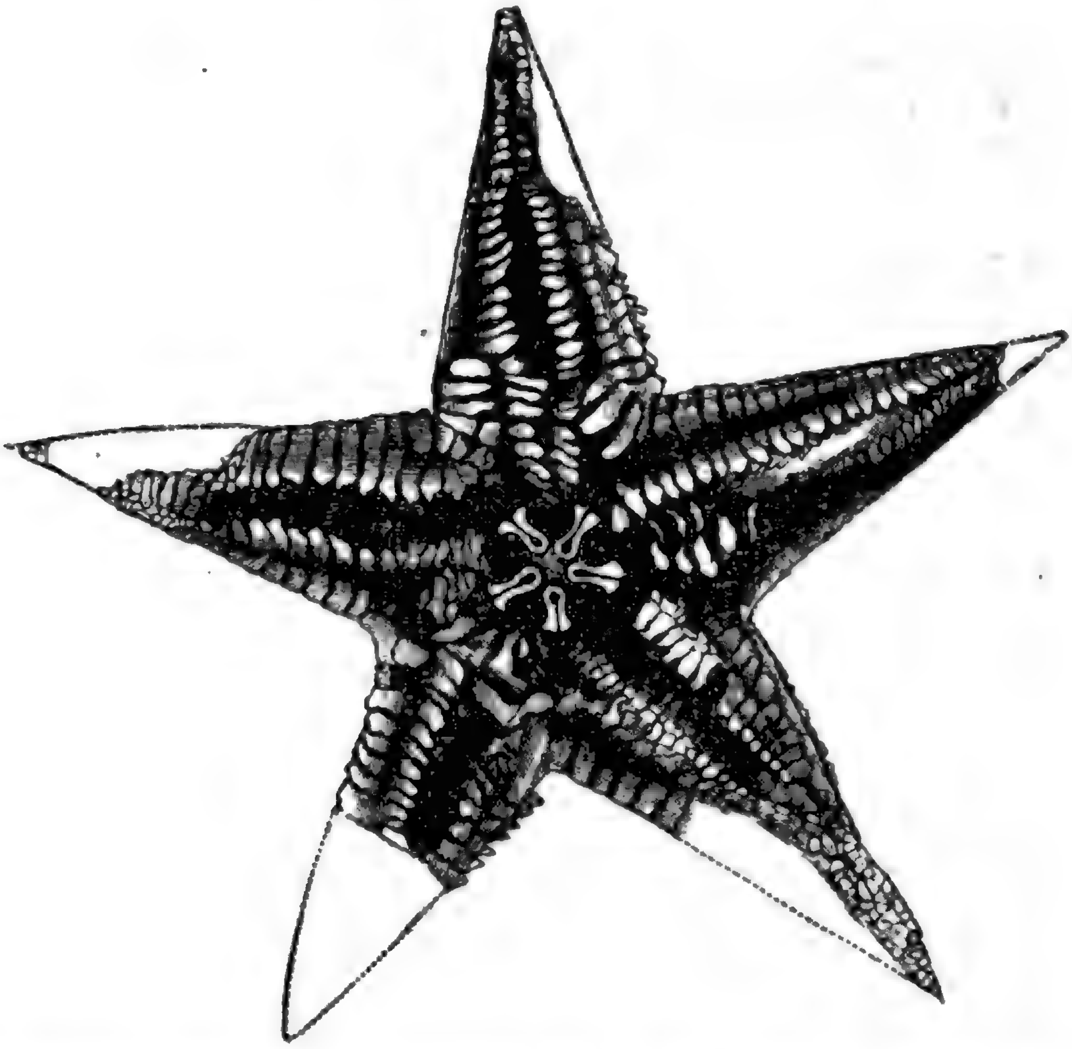
The formation of the organic spheres by successive envelopment around a centre, and their multiplication by subdivision, are such general facts as to require the whole attention of physiologists. They are observed in the *vitellus* of Mammalia, Batrachia, the osseous fishes, Mollusca, insects and worms. The so frequent production of these particular forms of matter proves, in opposition to the opinion of Schleiden and Schwann, that organized bodies are not exclusively composed of cells; but that other elements may also enter into the composition of their tissues, and that the organic spheres ought to be reckoned among these elements. They do not in fact appear only as a transitory modification of the vitelline matter undergoing the primary influences of fecundation, for they are also found in tissues which are undergoing development, and even in those which form a part of the adult organism. It is these which, by their juxtaposition in the Mammalia, give origin to the earliest and most important formation of the tissues of the germ, because the blastodermic membrane is formed at their expense; that is to say, that which will subsequently become the basis of the entire organism. It is true that by gradual conversion into cells they soon raise the blastodermic membrane to a higher degree of organization; but they reproduce it at a period when they are still simple granular spheres, and they then still enjoy all the properties of these spheres, so that after their incorporation they continue for a certain time to multiply by subdivision, as we shall show in a future memoir.

2. *Spondylosaurus;* by M. Fischer de Waldheim, (Bull. Soc. Imp. Nat. de Moscow, tom. viii, 1845; L'Institut, No. 624, Dec. 1845.)—The fossil to which the name Spondylosaurus has been given, was found by M. H. Frears, near Stchioukino, on the banks of the Moskwa, in the Oolite formation. Only a few vertebræ have been seen. The form and size of the vertebræ appear to place the animal between the Plesiosaurus and Ichthyosaurus. Their form is round, a little ovoid transversely. The anterior surface is concave and smooth; the posterior a little less concave. They are rather broader than long, and nearly cylindrical, with the middle a little smaller than the ends. There are only two apophyses, dorsal and costal. A process extends from these apophyses and unites with the transverse apophyses. The latter are situated exactly at the middle of the vertebræ and have a funnel shape; the rib must therefore have had a rounded head, and articulated freely in this cavity, with a ligament attached to the process just mentioned. The name of this species alludes to this peculiarity. The specific name given to it, is *Spondylosaurus Frearsii.*

3. *Thoracoceras, a new genus of the family of Orthoceratites;* by M. Fischer de Waldheim, (L'Institut, No. 631, Feb. 4, 1846, p. 48.)—The genus Thoracoceras is distinguished by having the transverse septa concave, imbricate or distant, and not surrounding entirely the siphuncle. The siphuncle is always marginal, sometimes thin, or appearing obliterated at the junction with the septa, and sometimes remarkably thick; and it may be either spirally contorted or annulated, or covered with scales or leaves. [This genus appears to be identical with Conrad's Cameroceras, instituted in 1842.—*Jour. Acad. Nat. Sci.* viii, 267.]

4. *Fins of Fishes afford important characteristics.*—Prof. Agassiz observes as a result of some late investigations, that the characters drawn from the fins of fishes, hitherto almost entirely neglected, are highly important to Zoology and Palæontology.

5. *Two species of Fossil Asterias in the Blue Limestone of Cincinnati;* by Messrs. G. Graham, J. G. Anthony, and W. P. James, (from the report of a Committee of the Western Academy of Natural Science, communicated by the Academy to this Journal.)—The largest of the two specimens, belonging to Mr. W. P. James, appears to be a true Asterias as the genus is at present constituted, having all the characters of that genus, so far as the examination of one side only enables us to judge. The specimen is in a very perfect state of preservation, having the rays nearly entire, and the spiny projections surrounding the mouth beautifully exhibited. The size of the fossil is that of the A. aurantiaca, of the British coast, being about 4 inches across.*



The smaller specimen, discovered by Mr. Robert Clark, we find to belong also to the Echinodermata, but to a different genus, the "Goniaster of Agassiz," commonly called the "cushion star," from the gibbous appearance of its upper surface. This specimen is very small, measuring not quite ⅜ of an inch from one extreme point to the opposite. Its outline is perfect, but it presents only its upper surface.

We regard the discovery of these two specimens of Echinodermata with peculiar interest. For a long time the Crinoidea were supposed to be the only representatives of Echinoderms in the blue limestone around our city. Subsequently the discovery of numerous remains of

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* The figure here given is reduced about one sixth lineally.

Agelocrinites in our strata, contributed a new member to the family; and now by the discovery of these interesting specimens, we are enabled to add two other genera, species of which have rarely been found in deposits anterior to the chalk.

The locality where these remains were found, is about one mile north of the city, near the Vine-street road, and about 300 feet above low water mark of the Ohio river. Near this spot have been found hundreds of very perfect Encrinites, having in many cases the column attached to the head; and also in the same vicinity occur fine specimens of Agelocrinites, rendering this locality a favorite one to the collector of fossil remains.

Cincinnati, March 30, 1846.

6. *Circulating fluid in the Planorbis imbricatus*, (L'Institut, No. 627, Jan. 1846, p. 4.)—M. Quatrefages has observed that in the Planorbis imbricatus, common in the fresh waters of the vicinity of Paris, the blood has the red color of the lees of wine. When but little magnified, the circulating fluid may be seen filling the cavities of the pericardium and ventricle, and at short intervals to color quite distinctly the general cavity of the body throughout its inferior surface.

7. *Siliceous shields of Infusoria from Guano.*—The guano from Ichaboe, when long digested in acids, leaves a siliceous residue, which, examined under the microscope, with a power magnifying from 200 to 400 linear, is found to consist entirely of the shields of Coscinodisca, Actinocyclas, &c. &c., of the most exquisite forms, and presenting the most beautiful play of colors.

8. *Zoological Researches.*

Annals and Magazine of Natural History, February, 1846, No. 108, vol. xvi.—An index to the British Annelides, (a full catalogue with synonyms and references,) by George Johnston. *February*, No. 110, vol. xvii.—Spiders of Canada, (continued,) J. Blackwall.—Notice of some birds from Western Africa, Sir W. Jardine.—Economy of the Paussidæ, W. J. E. Boyes.—Some undescribed Chalcidites, F. Walker.—Zoological Society, July 22, 1845; three new birds from Australia, Mr. Gould.—Aug. 12; new species of Murex, L. Reeve.—Aug. 26; on the genus Achatinella, L. Pfeiffer. *March*, No. 111.—Hyperoodon Butzkopp, with a figure, W. Thompson.—Caprolagus, a new genus of Leporine Mammalia, E. Blythe.—Some undescribed Chalcidites, (continued,) F. Walker.

Académie des Sciences de Paris, Dec. 8, 1845.—Development of the Medusæ and the Hydra Polyps, M. Dujardin. *Feb.* 2, 1846.—Report on M. Lereboult's Monograph on the Onisci of Alsace, with details of structure; by Milne Edwards. *Jan.* 5, 1846.—Anatomy of the Gastrochenia dubia, of the Mediterranean, M. Deshayes.

Société Philomatique de Paris, Jan. 17, 1846.—On the embryogeny of the Diptera of the tribe Ornithomyiens, (Pupipara of Lamarck,) M. Emile Blanchard.

Kongl. Vet. Akad. Handlingar, for the year 1843.—Monograph of the Swedish Ephydrinæ, by C. Stenhammar.—On the wings of Birds, C. J. Sundevall.—Myodes schisticolor and Sorex pygmæus, new Scandinavian mice, M. Silljeborg.

IV. ASTRONOMY.

1. *The new planet Astræa.*—In our last number we briefly noticed the discovery of a new planet. Having lately received much fuller intelligence respecting it, through the Astronomische Nachrichten, we proceed to lay it before our readers, regarding this as marking an epoch in the history of astronomy. The following is the letter of M. Hencke of Driesen to Prof. Schumacher, announcing his discovery.

Driesen, Dec. 10, 1845.

Having been employed day before yesterday in observations on the planet Vesta, on account of its great brilliancy at the present time, I examined attentively the stars in its vicinity and found one of the ninth magnitude which I had not seen before, not being found upon my chart, which contains many stars of the 9–10th magnitude, and all the brighter ones. Neither could I find it on the chart of the Academy, although Prof. Knorre bestowed extraordinary attention upon this region, and has included almost all the stars up to the 9–10th magnitude. The place of this stranger, reduced to the equinox of 1800, was in A. R. 64° 47′·5, and Dec. 12° 34′·7 N., Dec. 8th, at 8h.: lying between two stars of the 9–10th magnitude which are found on the chart of the Academy. Unfavorable weather prevented my searching for it yesterday, and probably will continue for some time to come; this notice is therefore for those who being favored with better weather are able and disposed to follow this stranger. It is very improbable that this should prove to be merely a variable star, since in my former observations of this region, which have been continued for many years, I have never detected the slightest trace of it. K. HENCKE.

The supposed discovery of a new planet was first verified at Berlin. The following is the letter of Prof. Encke to Prof. Schumacher.

Berlin, Dec. 15, 1845.

I think I am now able to announce to you a new planet. On the 13th of Dec. it was stated in Voss's Gazette that M. Hencke of Driesen, whom since the formation of our new charts of the stars I have known as a zealous amateur of practical astronomy, and who since that time has made for himself special charts of particular districts, had seen a new star of the ninth magnitude. Its place referred to the present equinox, was in A. R. 65° 25′, Dec. 12° 41′. Yesterday we searched in this region with the refractor, and found a star of the ninth magnitude, not given on the chart of the Academy, which we compared by means of the circular micrometer with a star of the Histoire Céleste, and found the following differences of R. A.:—$6^h\ 28^m$ m. t. $+49^s{\cdot}81$ in time.;—12^h 43^m m. t. $+34^s{\cdot}95$.

Hereupon we introduced the filar micrometer, and from a mean of 15 observations obtained the following place. Dec. 14, $13^h\ 56^m\ 59^s{\cdot}7$,

m. Ber. t., A. R. 64° 0′ 23″·6, Dec. 12° 39′ 53″·1. The star is retrograding like a planet near its opposition. ENCKE.

The new planet was observed at Altona and Hamburg on the 17th; at London and Cambridge on the 24th; at Pulkova on the 26th; at Bonn, Jan. 2d; and from this time it was followed at nearly all the observatories of Europe. The following are the observations made at Berlin, as far as they have been received.

	h. m. s.	° ′ ″	° ′ ″
Dec. 14	13 56 59·7, m. t.	A. R. 64 0 36.0	Dec. +12 39 49·6
15	7 12 9·3	63 50 54·1	12 40 0·5
16	10 20 16·5	63 36 5·6	12 39 57.1
20	7 38 51·2	62 48 6·4	12 41 31·5
21	7 49 38·4	62 36 27·0	12 42 16·9
27	11 29 14·6	61 33 46·4	12 49 51·8
31	8 0 18·9	61 2 57·3	12 57 17·3
Jan. 3	8 14 33·7	60 43 37·2	13 4 23·4
6	6 31 24·9	60 29 12·9	13 12 21·3

At Hamburg, on the 15th of January, 8^h 54^m 3^s·1, its place was in A. R. 60° 11′ 57″·5, Dec. 13° 43′ 58″·3.

The following are Prof. Encke's elements, deduced from his observations of the 14th, 21st and 27th.

Epoch of mean longitude, 1846, Jan. 0,	94° 48′ 11″·8	
Mean anomaly,	319° 2′ 54″·8	
Longitude of perihelion,	135° 45′ 17″·0	Mean equinox, 1846, Jan. 0.
Longitude of ascending node,	141° 10′ 6″·7	
Inclination,	5° 20′ 7″·2	
Eccentricity,	0·195520	
Semi major axis,	2·59158	
Mean motion,	850″·473	
Period,	1524 days.	

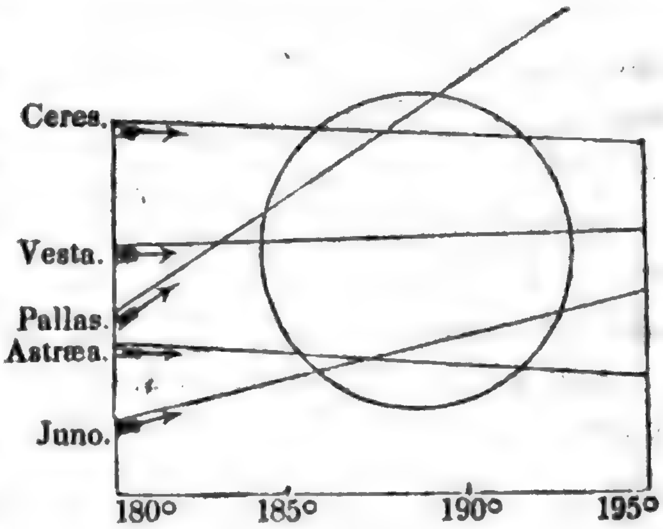
The following places were computed from these elements.

Feb.	1, 8^h m. B. t.,	A. R. 61° 28′ 49″,	Dec. 15° 3′ 47″ N.
	18,	64 55 48	16 39 31
March	6,	69 47 35	18 11 41
	22,	75 54 8	19 35 19
April	7,	82 59 30	20 41 52
	23,	90 49 30	21 24 31

The following comparison shows conclusively that Astræa belongs to the family of the asteroids.

	Node.	Inclination.	Eccentricity.	Period.	Distance.
Vesta,	103°	7°	0·088	1335	2·373
Astræa,	141	5	0·195	1524	2.592
Juno,	170	13	0·254	1591	2.667
Ceres,	81	11	0·079	1682	2.767
Pallas,	172	34	0·240	1682	2.768

The opinion has been often expressed that the asteroids are the fragments of a large body which once existed between Mars and Jupiter. This opinion has lost none of its plausibility by the discovery of Astræa. Indeed in the position of its node, in its period and eccentricity, this planet conforms very nearly to the mean of the elements of the four former planets. It was remarked by Dr. Olbers that according to the above hypothesis, since the orbits must all have diverged from the same point, so they must have two common points of reunion in opposite parts of the heavens. The following diagram will show how nearly this conclusion conforms to observation.



This diagram represents a portion of the orbits of the asteroids as seen from the sun, corresponding to a heliocentric longitude of 180° to 195°, and the circle which is added has a radius of four degrees. We perceive then that a circle of four degrees radius embraces at least five degrees of the orbit of each of the Asteroids, *Astræa included.* We see also that if this small circle had been faithfully watched for four years, these five planets must all have been discovered. This is precisely what Olbers undertook to do, and his search was rewarded by the discovery of Vesta. With such perseverance did he maintain the watch, that he announced that no new planet could have passed between 1808 and 1816. In this he was certainly mistaken; Astræa glided by him unperceived.

In may be thought that the above theory requires that the orbits should all pass, not *almost*, but *exactly* through the same point. The answer to this objection is, that the orbits are disturbed by the attraction of the other planets, and that we may readily admit that at no very distant period, the orbits *did* all pass through a common point.

It may be interesting to compare the dates of all those planets, the period of whose discovery is known. They are as follows :—

Uranus,	March 13, 1781,	by Herschel.
Ceres,	Jan. 1, 1801,	Piazzi.
Pallas,	March 28, 1802,	Olbers.
Juno,	Sept. 1, 1804,	Harding.
Vesta,	March 29, 1807,	Olbers.
Astræa,	Dec. 8, 1845,	Hencke.

This last discovery may perhaps excite astronomers to set a new watch, to intercept any other planets which may presume to venture upon this field of a former catastrophe.

2. *Biela's Comet.*—In our last number, we gave a short notice of the discovery of this comet. It was seen at Rome by M. De Vico, on the 26th of November, the earliest observation of which we have received any account. It was observed at the same place, Nov. 28th, 29th, and Dec. 1st.

The comet was seen at Berlin for the first time, Nov. 28th, and again on the 29th, but so faint that Prof. Encke could with difficulty satisfy himself of its existence. Its place differed about six minutes of arc from the ephemeris of Santini, a coincidence quite satisfactory, considering that the comet had not been seen for fourteen years.

The comet was seen at Cambridge, Eng., on the 1st of December, and again on the 3d. It was observed at London by Mr. Hind, December 19th and 20th; and on the 21st, Dr. Galle, at Berlin, was able to observe it with illuminated lines.

On the 2nd of January, M. Struve writes from Pulkova, that he had not been able to see the comet, and on account of its small elevation above the horizon, had given it up entirely for this return.

The most remarkable circumstance attending this return of Biela's comet, is that it has been attended by a companion like a secondary comet. This secondary comet has been remarkable for its changes of brilliancy and of distance from Biela. On the 29th of December,* the companion was merely a faint nebulous spot, barely distinguishable; but from this time it increased in brightness faster than Biela. On the 13th of January, it was estimated to have one fourth the intensity of Biela, and one eighth the magnitude. On the 16th of February, it was estimated to be equal to Biela as to magnitude, and to have one third more intensity. Two days afterwards, Biela was estimated to exceed its companion at least twofold, both in quantity and intensity of its light. From this time the companion dwindled away most rapidly, and by the fore part of March, it was so faint as to be very difficult of measurement, although Biela continued in good view.

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* According to observations made at this date by Messrs. Bradley and Herrick at Yale College, with the refractor of five inches aperture, the angle of position of the line joining the main comet and its companion (the latter being then a dim nebulous spot N. preceding, and causing the appearance of a tail in that direction) was then about 310°, reckoning N. *f.* S. This angle was obtained by means of independent diagrams of the field of view by each, which gave results differing but five degrees. It is of course liable to considerable error. The moon at this time was absent, and the sky very favorable for observation.

On the nights of March 30 and 31, an attempt was made by the same observers to ascertain the distance between the comet and its companion. The latter was barely within the limit of visibility, and could be detected only by occasional glimpses. By means of a diagram of the field, the angular distance of the centres of the two bodies was estimated to be sixteen minutes of arc.

By the middle of April, the comet (Biela) had become very faint. Mr. Bradley determined its place (mean of two measures by the ring micrometer with star 62 of Bessel's zone 231, and two with star 64 of the same) at 11*h*. 3*m*. sid. t. N. H., Apr. 16, to be 53*s*. preceding, and 1′ 50″ South of the latter star, the registered place of which is R. A. 9*h*. 7*m*. 59.22*s*.; S. dec. 12° 22′ 9″.

This companion was perhaps equally remarkable for its changes of distance from Biela. The 1st of January its distance was about one minute of space. Jan. 14th, the distance was 1′·6; Feb. 18, distance 5′·8. The distance of the comet from the earth Jan. 14th, was ·790; Feb. 18, ·502; so that if we suppose the line joining the two bodies to have been constantly presented to us at the same inclination, their absolute distance from each other must have more than doubled in one month. Prof. Challis, of Cambridge, Eng., noticed this phenomenon for the first time, Jan. 23, and has furnished the following table of relative positions.

	Mean time.	Difference of A. R.	Difference of Dec.	Angle of position.	Distance.
	h.	s.	″	° ′	″
Jan. 23, . . .	7·1	5·18	122·9	327 43	145·4
" 24, . . .	7·0	5·11	126·6	328 48	148·0
" 27, . . .	6·4	5·84	144·6	328 48	169·1
" 28, . . .	6·3	5·77	151·1	330 12	174·1
" 29, . . .	7·4	5·44	154·4	332 10	174·6
Feb. 11, . . .	7·4	7·38	249·7	336 8	273·1
" 12, . . .	7·1	7·86	252·7	335 3	278·7
" 13, . . .	7·5	8·30	264·9	334 54	292·6

3. *The Bond Comet.*—A new telescopic comet was discovered by Geo. P. Bond, of the Cambridge (Mass.) Observatory, on the evening of February 26, 1846. The following parabolic elements of the comet were obtained by Mr. Bond, from observations thereto annexed taken at that observatory, and referred to the mean equinox of January 1, 1846.

Perihelion passage,	Mch. 5.5376 Greenw. m. s. t.
Perihelion distance,	0·6673
Longitude of perihelion,	89° 51′ 15″
" " asc. node,	76° 59′ 29″
Inclination,	84° 46′ 32″
Motion,	direct.

1846. Camb. m. s. t.					
Feb. 26.3415.	A. R.	$1^{h}\ 0^{m}\ 25{\cdot}7^{s}$	N. Dec.		3° 19′ 17″
Mch. 1.3164.	"	$1^{h}\ 0^{m}\ 32{\cdot}9^{s}$	"	"	8° 8′ 35″
" 4.3215.	"	$1^{h}\ 0^{m}\ 1{\cdot}5^{s}$	"	"	12° 46′ 5″

The subjoined set of parabolic elements was obtained from observations made by Mr. Francis Bradley, at the Yale College Observatory.

Perihelion passage,	March 5.0019	Greenw. m. t.
Distance,	0.6673	
Longitude of perihelion,	88° 44′ 39″	
" asc. node,	77° 16′ 32″	
Inclination,	84° 46′ 33″	
Motion,	direct.	

The following are the observed places, referred, without correction, to the mean equinox of Jan. 0. 1846.

		h.	m.	s.		°	′	″		°	′	″
1846. Mch. 5.	Sid. t. N. H.	6	25	0	R. A.	14	56	4·34	N. Dec.	14	14	44·34
9.	"	7	11	13	"	14	25	30·37	"	19	51	58·31
19.	"	7	22	33	"	12	20	33·62	"	31	42	48·16

Prof. Benjamin Peirce, of Harvard University, has published the following communication relative to the comet, in the Boston Courier, under date of March 26, 1846.

"Having been unable to satisfy the observations made by Mr. Wm. C. Bond, the director of the observatory, upon the comet discovered by his son Feb. 26, by any parabolic orbit which I could obtain, I have applied the general method of computation to the observations of Feb. 26, March 9, and 18. I have obtained the following orbit, having a period of revolution of 95 years, which completely satisfies the observations of Feb. 26, and March 1, 2, 3, 4, 6, 9, 10, 11, 12, 17, 18, 21. The period of revolution cannot be relied upon as accurate within several years, but if the comet should be visible as late as June or July, I think it may be determined within a year. There seems a reasonable expectation that it will be seen at that time, and I hope the telescope of 4½ inches aperture just received at the observatory, from Simms, of London, will enable Mr. Bond to take observations upon it.

Perihelion passage,	March 5.49947	Gr. m. s. t.
" distance,	0.664316	
Mean dist. from sun,	20.80761	
Eccentricity,	0.9680734	
Period,	94.9147	years.
Inclination,	85° 11′ 29″·5	
Long. of asc. node,	77° 29′ 47″·5	Mean equin. Jan. 1, 1846.
" perihelion,	90° 16′ 19″·2	
Motion,	direct.	

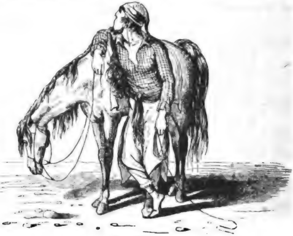
"The small difference in the elements between this orbit and Mr. Geo. P. Pond's parabola, arises almost wholly from the introduction of the period of revolution as an element of calculation."

4. *First Comet of* 1846, (N. Y. Jour. of Com., Mch. 25, from Lond. Times, Feb. 12.)—M. De Vico, at Rome, discovered a comet in the constellation *Eridanus*, January 24, 1846. At 10h 38m 17s·8 m. t.

Our philologist related an anecdote of a young Indian, who had learned the Spanish tongue, whom he had been questioning relative to his language, in order to obtain a certain class of phrases. After having written down a word, in repeating it, he connected it with some adjunct, as *my* father, *his* house, *this* knife. The Indian mistook his meaning, and immediately took fire at the supposed insult, thinking that the correctness of what he had said was doubted, and that the object was to entrap him in a falsehood. It was with some difficulty that he was pacified.

The Guachos and Indians are of course good horsemen, being trained to it from their infancy. Indeed they may be said to live on horseback, and it is very seldom that they are seen to walk any distance, however short.

Their dress, although uncouth and ill-arranged, is comfortable, and picturesque when they are on horseback, particularly when at full speed in search of a bullock to lasso. The ease and nonchalance with which a Guacho mounts his steed, arranges himself in the saddle, quietly trotting off, lasso in hand, to select his victim, and detach it from the herd; then the eager chase, the furious speed of the horse, the flying dress of the Guacho, with upraised arm whirling his lasso, the terror of the animal, the throw of the lasso, and instantaneous overthrow of the bullock, all the work of an instant, excited both our admiration and astonishment. Nothing can exceed the animation of both horse and rider on these occasions.



GUACHO.

Mr. Waldron, our purser, made an endeavour to purchase some vegetables for the crews, from an estancia on the river-side, of which an old Spaniard was the owner, thus affording him an opportunity of

Rome, its R. A. was $4^h\,6^m\,59^s{\cdot}2$, and S. Dec. 7° 11′ 30″·6. Its hourly motion was $1^s{\cdot}434$ to the East, and 2′ 56″ to the North.

5. *Comet of* 1844–45; by J. C. Haile, Esq., (Athenæum, No. 956, 1846, p. 201.)—Mr. Haile has presented to the Royal Society a series of observations on the comet of 1844–45, accompanied by a diagram, made by him at Auckland, New Zealand. The comet appeared on the 20th of December, 1844, and is said to have disappeared on the 30th of January following. Its most remarkable feature was, that during its greatest brilliancy, the nucleus was not surrounded by the nebulous matter, but was situated at the very extremity of the head, and at times appeared quite detached. (See farther, *Southern Comet of December*, vol. xlviii, p. 402, of this Journal.)

6. *Planet Saturn.*—Sir John Herschel states as a fact obvious enough, but not before noticed, that the periodic time of the first satellite of Saturn (first in order of the ring) is *precisely half* that of the third, and the periodic time of the second *precisely half* that of the fourth.

V. Miscellaneous Intelligence.

1. *Anastatic Printing.*—We have before noticed this important improvement (American Jour. Sci., vol. xlix, p. 401) in the art of printing, by means of which printed or written documents may be multiplied in fac-simile to any extent, by a process similar to that by which lithographic printing is done; a metallic plate (zinc) being used in place of the stone. We take pleasure in laying before our readers a specimen of this art in the annexed pages, from the narrative of Capt. Wilkes, copied by the anastatic press of Mr. Robt. P. Smith, (who is agent for the American patentees,) 144 Chesnut-st., Philadelphia. As we have before described the process, it is unnecessary to repeat it here. We have before us numerous other specimens of the art as practised by Mr. Smith; pages from scientific books, illustrations from the London Times, copies of manuscripts, maps, music, autographs, and handbills, many of which are done with great beauty and clearness. The printing, like the lithographic, is slow and expensive, compared with the rapid motions of the power press. The art may however be considered in its infancy, and great improvements may be looked for, which will extend its applications and cheapen its cost. In its present state, however, it has a wide and most useful application. The cost of a *single* page like one of those opposite, is now about $10, including the paper and press-work for 1400 copies; the same work in common type and printing, would cost about $4. It will be seen that this is far less, however, than the art of lithography.

2. *Electro-culture*, (Jameson's Journal, Jan. 1846, p. 153.)—Dr. Fyfe concludes from an extensive series of experiments on the application of

electricity to the growth of vegetation, that no benefit whatever has accrued from the different processes followed. He does not assert, however, that electricity can be of no avail in promoting vegetation, though doubting strongly its use. The further prosecution of the subject by trials on an extended scale is recommended.

3. *On the death and disappearance of some trees and shrubs;* in a letter from W. JONES, dated Riceboro, Georgia.—The present remarks are particularly directed to the death and disappearance of some of our trees and shrubs. The first that I will mention is the Castanea pumila, which is a tree from 10 to 30 feet in height. In the year 1825, during the months from June to September, I observed this tree dying when in full leaf and with fruit half matured. I examined numerous individuals and could find no internal cause of their dying. I at first attributed it to the great fall of rain which took place in the year 1823; for during the month of July of that year, a considerable quantity of land not subject to overflow was covered with water for some time, and the highest lands were completely saturated. The latter part of 1824 was also very rainy. Knowing that this tree belonged in our highest and driest soils, I concluded that it was owing to a too moist state of the ground. But since that time I am convinced there must be some other cause; for the tree continues still to die, up to the year 1845, and if the disease is not arrested, in a few years I fear it will be entirely exterminated.

In the year 1826 I discovered also that the Laurus geniculata showed the same signs of dying, and many died in the course of that year. The Laurus geniculata in the southern part of Georgia formed beautiful round groves in the pine barrens. From one spot I have viewed three or four of these round ponds (as they are called by the inhabitants) through the tall Pinus palustris, which tree forms the forest of these barrens; and contrasts with the Laurus in its deep green foliage as well as size. At this time, these once beautiful spots amid the pine forest are all exterminated; and I have not seen a single individual alive within the last five years. The Gordonia liseanthus, a very beautiful tree which once abounded in this region, has almost entirely disappeared from some localities. I have known whole forests of these trees, for miles in extent, (where they formed bays or branches,) to die in the course of two or three years, leaving not a single individual to mark the spot where they once grew. The Quercus rubra also for the last six years has been going in the same way. I have noticed this tree in situations favorable to its growth, to put out its leaves in the spring, grow very little and appear sickly during the summer months, and the next spring put out again and then suddenly die. I have observed a few individuals of the Laurus sassafras also dying. I have no where seen any account of a similar death among the trees of our forests, and it is to be hoped that some one may give the subject their consideration and assign the cause.

4. Prof. LOUIS AGASSIZ *of Neufchatel, Switzerland.*—This distinguished naturalist, who is known wherever science is cultivated, is about to visit the United States. His intention has been, for some time, privately announced by him to his scientific friends in this country, and we are now assured by a recent letter from himself, that leaving Neufchatel in February, he would spend some weeks in Paris, before passing to London, but that he would not leave England for America before April; probably we may expect his arrival at New York or Boston in the course of the month of May.

He enjoyed the friendship and confidence of Cuvier, who committed to him the charge of carrying forward the Natural History of Fishes, which Cuvier had begun. His great work on fossil fishes is finished, except that new discoveries will, from time to time, demand its extension. His publications on the Echinodermata are far advanced; we have splendid examples of the work on modern fishes, and his study of the glaciers of Switzerland and the vicinal Alps formed an episode in the midst of his labors in various departments of natural history. All his works are illustrated by numerous figures and drawings, distinguished alike for accuracy and beauty. Having been favored by the author from time to time, by receiving the results of his numerous and arduous labors, they have been mentioned in various numbers of our first series. Prof. Agassiz, by the friendship and advice of Alex. von Humboldt, enjoys the *substantial* patronage of the king of Prussia, and will pass two years in the United States, aided by a taxidermist or preparer of specimens in natural history, and by a draftsman to copy the various objects, especially fishes and molluscous animals, and the corresponding fossil families will of course be included. His devotion, ability, and zeal—his high and deserved reputation, and (as we are assured from unquestionable sources) his amiable and conciliating character, will, without doubt, secure for him the cordial coöperation of our naturalists, and the favor of the public wherever he may travel over our vast territory. We recommend him and his cause to all lovers of science and of mankind. He is strongly impressed by the activity and success of our own naturalists, (although few of them are able to cultivate science exclusively,) and he is most anxious to form their personal acquaintance and to obtain their assistance. We have no doubt that as a powerful auxiliary and fellow laborer in a common cause, he will be every where received with cordiality, and seconded by efficient aid; nor do we entertain a doubt that we shall be liberally repaid by his able review and exploration of our country.

5. *Lake Torrens, South Australia;* (Athenæum, No. 955, Feb. 1846.)—Much has been written about Lake Torrens, which Mr. Eyre first stated to exist to the north of Spencer Gulf in South Australia, near latitude 30° and longitude 139° or 140°. Ascending an elevation, it appeared to him to stretch away to the northeast as far as the eye could reach, apparently about 30 miles broad, and seeming to be bounded on its western shores by a low ridge or table land, beyond which nothing could be seen. In 1843, Captain Frome visiting the region, found the lake to be only a semblance of one due to mirage, and its islands low sandy ridges. A salt crust was seen at intervals on the surface of the sand at the margin of the lake, or, as it would be more properly styled, the desert. The same region was visited by Mr. Poole in 1845, who encamped on the eastern margin of the lake in longitude 141° 40′, and latitude 29° 40′. He found a sandy desert, and only some pools of water, forming a succession of lakes, produced by the drainage of the hills. He remarks, however, "that the country on approaching Lake Torrens is so peculiar that any one looking down upon it from such lofty eminences as Mount Serle and Mount Hopeless would naturally conclude that the whole was the large bed of a lake."

6. *Infusoria in Guano.*—In connection with the statement on page 442, from an English source, reference may be made to J. W. Bailey's observations, Vol. xlviii, p. 338, of this Journal.

7. *The Collection of Fossils of Herr Munster of Bayreuth* has been purchased by the government of Bavaria. According to the Munich accounts it consists of 150,000 specimens and is one of the richest in existence. The greater part of the specimens are from the rocks of Bavaria and the adjoining countries.

8. *Height of Vesuvius;* (L'Institut, No. 628, Jan. 1846, p. 10.)—M. Pentland makes the height of the highest point of Vesuvius, above the sea, (la Punta del Palo,) 1203¼ metres, or 3864½ feet. It is stated that this point has not varied its altitude for many years.

9. *Italian Congress of Science.*—The eighth scientific congress of Italians will be held at Genoa in the beginning of May, and preparations are said to be made to give the Savans a hospitable reception.

10. The Queen has conferred the honor of Knighthood upon Roderick Impey Murchison, F. R. S. This distinguished geologist has also been knighted by the Russian emperor, being made a knight of the first class of the Imperial Russian Order of St. Stanislaus.

The honor of Knighthood has also been conferred upon Dr. John Richardson, F. R. S., the celebrated Polar traveller, and medical inspector of hospitals and fleets.

BIBLIOGRAPHY.

1. *Annals of the Lyceum of Natural History, of New York.*—No. 5, of vol. iv. of the Annals is just issued. The following is a list of its memoirs:

Monograph of the species of Pasimachus inhabiting the United States, with descriptions of two new genera belonging to the family Carabica, by J. L. LeConte, p. 141, with figures.

A new species of Apus (A. longicaudatus) by J. Le Conte, p. 155, with a figure.

Three new fossils from the Falls of the Ohio, by J. Cozzens, (Piliolites Ohioensis, a new genus and species of Crustacea, Pentagonia Peersii, Conulites elevata,) p. 157, with figures.

On certain Coleoptera indigenous to the Eastern and Western Continents, J. L. Le Conte, p. 159.

Descriptions of some new species of shells. J. H Redfield, p. 163, with figures.

Description of some new shells, by J. C. Jay, p. 169, with figures.

The officers of the Lyceum for the year 1846, are as follows:

President, Major Joseph Delafield. 1*st Vice President*, John Augustine Smith, M. D. 2*d Vice President*, Abraham Halsey. *Corresp. Secretary*, John H. Redfield. *Recording Secretary*, Robert H. Browne. *Treasurer*, Jacob P. Giraud, jr. *Librarian*, Robert H. Browne. *Publishing Committee*, Major John Leconte, Abraham Halsey, William C. Redfield, Jacob P. Giraud, Jr., William A. Seely.

2. *Transactions of the American Philosophical Society*, *Philadelphia*, vol. ix, part 2.

On two storms in the United States, February, 1842, Elias Loomis.

On the conversion of benzoic into hippuric acid, J. C. Booth and M. H. Boyé.

Account of the observatory and instruments of the United States Military Academy at West Point; with observations on the Comet of 1843, by W. H. C. Bartlett.

Character and prospects of the Copper region of Gibara, and a sketch of the geology of the northeast part of the Island of Cuba, by R. C. Taylor.

Notice of fossil arborescent ferns of the family of Sigillaria and other coal plants, exhibited in the roof and floor of a coal seam in Dauphin County, Penn., by R. C. Taylor.

Description of some new fossil shells, from the tertiary of St. Petersburg, Virg., by H. C. Lea.

3. *American Academy of Arts and Sciences, Boston.*—A volume of the transactions of this society, will appear in the course of the month of May. We are informed that the printing of the next volume will proceed without interruption; it will be published in half volumes or smaller parts.

4. *Bibliothèque Universelle, Geneva.*—A supplementary monthly Journal, of 100 pages, has been added to the Bibliothèque Universelle, entitled *Archives des Sciences Physiques et Naturelles.* The first

number was to appear in February last. It is under the editorship of MM. de la Rive, Marignac, and Pictet. Price 30 fr. per year; or 55 fr. in connection with the other branch of the Bibliothèque Universelle.

5. "*Phycologia Britannica: or History of the British Sea-Weeds*, containing colored figures, generic and specific characters, synonymes and descriptions of all the species of Algæ inhabiting the shores of the British Islands, by William Henry Harvey, M. D., M. R. I. A., Keeper of the Herbarium of the University of Dublin. Roy. 8vo.; to be completed in sixty monthly parts, each containing six colored plates, with descriptive text; price 2*s*. 6*d*.; large paper, 5*s*."

We have not seen this work, but the name of Mr. Harvey, the accomplished author of the *Manual of British Algæ*, affords the highest guaranty of its accuracy and value. A. Gr.

6. *Hooker's Species Filicum*, etc.—The third part of this work, which has just reached us, is principally occupied with the genus *Davalia*, (pp. 129–142, plates 40 to 60 inclusive.) The *Botany of the Niger Expedition*, by Sir Wm. and Dr. J. D. Hooker is announced, to which a biography of Mr. Vogel, the naturalist, who perished in that ill-starred enterprise, is to be appended. A. Gr.

7. Hassall, *History of the British Fresh-Water Algæ, including descriptions of the Desmideæ and Diatomaceæ*, 1 vol. 8vo. of text, with an accompanying volume of plates (100 in number,) colored after nature. This work will prove a very needful help to the student of these minute and hitherto most obscure tribes, although in some particulars,—not however affecting the general value of the work,—Mr. Hassall has been quite severely criticised in some of the English Journals.

8. Martius, *Palmarum Genera et Species.*—We are informed that the 8th part of this magnificent work is on the eve of publication. Indeed it has probably appeared at Munich before this, and the remainder of the work is promised in August or September, so that this great undertaking will probably be brought to a conclusion in the course of the present year. A. Gr.

9. Ledebour, *Flora Rossica.*—The 6th part of this work (part 2nd of vol. 2) was published during the past year. It is occupied with the *Compositæ*, of which it includes nearly all the *Tubulifloræ*. *Illustrations of the Russian Flora by Dr.* Trautvetter, (*Plantarum imagines et descriptiones floram Rossicam illustrantes*,) are in the course of publication, but no part of the work has yet reached us. A. Gr.

10. Boissier, *Voyage Botanique dans le Midi de l'Espagne;* Paris, 1839–1845, 2 vols. roy. 4to.—The first volume of this beautiful work is occupied with the narrative of M. Boissier's tour,—which is full of interest,—with a treatise on the Geographical Botany of Granada, and with the plates of the systematic part of the work, over 200 in number,

which are finely engraved from drawings by Heyland and are half-colored. The second volume consists of a complete enumeration of the plants of the old kingdom of Granada, so far as yet known; and the large number of new species here described, affords an indication of the rich harvest which the author has gathered in a region which, it appears, had been less explored by botanists than any other part of Europe.

11. *Botany of Mexico.*—The largest collection of Mexican plants ever made, is that recently brought by M. Liebmann, to Copenhagen. It is said to amount to 8000 species. The collection is to be published, in the finest style, at the expense of the Danish government. The first volume, now in press, will contain the Palms. The study of the Coniferæ is committed to Prof. Zuccarini, of Munich, who has recently so ably illustrated the Coniferæ of Japan. The plants of the order Compositæ in Liebmann's collection, are said to comprise fully a thousand species: they are to be elaborated by M. Steetz.

Southern Ichthyology, or a Description of the Fishes inhabiting the waters of South Carolina, Georgia and Florida; I. E. Holbrook, M. D. 4to. *Philadelphia.* To be issued in numbers every two months; price one dollar each. Will be completed in two or three years.

Report of a Geological Exploration of part of Iowa, Wisconsin and Illinois, made under instructions from the Secretary of the Treasury of the United States, in 1839, by D. D. Owen; 192 pp., 8vo, with views, sections and numerous figures of fossils.

Medical application of Electricity, with description of apparatus and instructions for its use. 21 pp., 12mo, 1846. *Boston.*

Report on Standards of Weight and Measure for the state of Maryland, on the constitution of the yard measure, by J. H. Alexander. 214 pp., 8vo, 1846. *Baltimore.*

Transactions of the Linnæan Society; 4th part of vol. xix.

Annuaire du Bureau des longitudes pour l'année 1846. 1 vol. 18mo. *Paris.* 1*fr.* 50*c.*

Report on Zoology for 1843, 1844, (Arsberättelse om Zoologiens Framsteg, &c.,) by C. H. Boheman. 8vo, *Stockholm*, 1845.

Report by Berzelius on Chemistry and Mineralogy for the year 1845. (Arsberättelse om Framstegen i Kemi och Mineralogi af Jac. Berzelius.) *Stockholm*, 1845.

Experimental Researches in Electricity, by M. Faraday. Vol. ii, with 5 plates. *London.* 9*s.*

Traité élémentaire d'astronomie physique, par M. Biot. 4 vols., with 65 plates in three atlases, 3d edit. *Paris.* 49*fr.*

Recherches geologiques sur les iles de Ténériffe et de Fogo, par M. Ch. Delville. 1 vol., 4to, with plates. *Paris.*

Essai sur le Système Silurien de l'Amerique Septentrionale, by M. de Castelnau. 1 vol., 27 plates, 4to. *Paris.*

Leçons de geologique pratique, par L. Elie de Beaumont. Vol. i, 8vo, 1845. *Paris.* Will form three volumes.

Die im Bernstein befindlichen organischen Reste der Vorwelt, gesammelt in Verbindung mit Mehrehren bearbeitet und herausgegeben von Dr. Georg Carl Berendt. *Berlin.*

Geschichte der Urwelt, mit besonderer Berückstichtigung der Menschenracen und des Mosaischen Schöpfungsberichtes, von J. And. Wagner. 8vo, 1845. *Berlin.*

Verhandlungen der Russisch-Kaiserlichen Mineralogischen Gesellschaft zu St. Petersburg, 1843, 1844, 2 vols. with several lithographic plates of fossils and geological sections. 8vo, *St. Petersburg.*

Physical Description of New South Wales and Van Dieman's land, by P. E. de Strzelecki. 1 vol. 8vo. *London.* (The result of extensive scientific explorations; contains figures of numerous fossils, &c.)

The Geology of Russia in Europe and the Ural Mountains, by Roderick Impey Murchison, F. R. S., &c., Edward de Verneuil, and Count A. von Keyserling. 2 vols. 4to, with numerous plates. 1845.

Zoology of South Africa. Royal 4to, with numerous colored engravings. *London.*

Anatomische Untersuchungen über die Edentaten, W. v. Rapp. Large 4to, 9 lith., 1845. *Tübingen.*

Die Forst-Insecten, oder Abbildung und Beschreibung der in den Wäldern Preussens und der Nachbarstaaten als Schädlich oder nützlich bekannt gewordenen Inseckten, von J. T. C. Ratzeburg. *Berlin.*

Naturgeschichte der Insecten Deutschlands, Dr. W. F. Erichson. *Berlin.*

Choix des plantes de la Nouvelle Zélande, by M. E Raoul. 1 vol. 4to, with 30 plates. *Paris.* 30 *fr.*

Zoology of the Beagle. 4to. *London.* 8£ 15*s.*

Zoology of the voyage of the Sulphur. 4to. *London.* Parts 1, 2, Mammalia, by J. E. Gray; 3, 4, Birds, by Dr. Gould; 5, Ichthyology, by Dr. Richardson; 6, 7, 8, shells, by R. B. Hinds.

In course of Publication.

Fauna Antiqua Sivalensis, or Fossil Zoology of the Sewalik hills, in the north of India, by Hugh Falconer and P. T. Cautley: to appear in about 12 parts, each with 12 to 15 folio plates, the letter press in roy. 8vo. Parts 1 and 2, contain the Proboscidea.

Zoologica Typica, or figures of new and rare mammals and birds described in the Proceedings or exhibited in the Collections of the Zoological Society of London. To form 20 monthly parts. Small folio. The first appeared in Sep. 1845. Colored, 10*s.* 6*d. each.*

Natural History of the Mammalia, G. R. Waterhouse. Imp. 8vo, with plates. In monthly numbers, 6 of which had appeared in March. 2*s.* 6*d.* each; colored, 3*s.*

Histoire Naturelle des Mollusques, par M. Deshayes; a work forming part of the results of the Scientific Exploration to Algiers in 1840, '41, '42; issuing in numbers, 16*fr.* each.

Genera of Birds, by G. R. Gray, with about 350 plates by D. W. Mitchill. Imp. 4to. *London.* To be completed in about 50 monthly parts, about a third of which have been issued.

Genera of Mammalia, by J. E. Gray. Imp. 4to, with 175 plates. *London. Preparing for publication.*

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FOREIGN SCIENCE.

Magnetical and Meteorological Observations made at the observatory in Toronto, Canada. Printed by order of her Majesty's Government, under the superintendence of Lieut. Colonel Edward Sabine, of the Royal Artillery. Vol. I, 1840, '41, '42. London, 1845.

Proceedings of the Geological Society of London. With plates in illustration of the papers. Session, 1843, '44, '45. Vol. IV, No. 100, 101, 102, 103.

Quarterly Journal of the Geological Society of London. 4 Numbers, 1845. From the Editor.

Geology, by Prof. David Thomas Ansted. 2 Vols., 8vo. London, 1844. From the Author.

The Geologist's Text Book, by David Thomas Ansted. London, 1844.

Proceedings of the Royal Society of Edinburgh. Vol. I. Dec. 1832, to May, 1844.

Observations on the Utility, Form and Management of Water Meadows, and the Draining and Irrigating of Peat Bogs, with an Account of Prisley Bog, by William Smith, Engineer and Mineralogist. England, 1806.

Three Memoirs on the Teeth and Epithelium, by Alexander Nasmyth. London, 1841.

Proceedings of the Geological Society of London. Vol. IV, No. 97.

Notes of a Microscopic Examination of Chalk and Flint, by Dr. G. A. Mantell. Three copies.

Description of some fossil remains of Dinotherium, Giraffe, and other Mammalia, from the Gulf of Cambray, by H. Falconer, M. D., F. R. S.

On Vision at Different Distances, by Prof. Forbes. Edinburgh. From the Author.

Views and Maps, illustrative of the State of New Hampshire, by Charles T. Jackson. One copy from the Author.

On two Storms which were experienced through the United States in the month of February, 1842, by Elias Loomis, Prof. of Mathematics and Natural Philosophy in the Western Reserve College. Read before the Philosophical Society of Philadelphia, May 26, 1843. One copy from the Author. 1845.

The Use of the Blowpipe in Chemistry and Mineralogy, by J. J. Berzelius. Translated from the fourth enlarged and corrected edition, by J. D. Whitney. From J. D. Whitney.

A Brief Practical Treatise on Mortars, with an account of the processes employed at the public works in Boston, by Lieut. William H. Knight, United States corps of Engineers. Two copies.

Reliquiæ Baldwinianæ: Selections from the Correspondence of the late William Baldwin, M. D., Surgeon U. S. N., with occasional Notes and a short Biographical Memoir. Compiled by William Darlington, M. D. One copy from Henry C. Townsend.

Universal Pronouncing Gazetteer, with a Map, by Thomas Baldwin—assisted by several other gentlemen. From J. Thomas, M. D. 1845.

An Elementary Treatise on Astronomy, in four parts, &c., designed for use as a Text-book in colleges and the higher academies, by William A. Norton, A. M., Prof. of Mathematics and Natural Philosophy in Del. College, &c. 1845.

Transactions of the N. Y. State Agricultural Society, 1843. One copy from the N. Y. State Ag. Soc. By Henry O'Reilly, Recording Secretary.

Supplemental Report of the Agricultural Society of the State of South Carolina, for 1843. Edmund Ruffin, late Agricultural Surveyor, S. C.

An Inaugural Dissertation on Chemical Classification, by Oliver Wolcott Gibbs, A. M. February 6th, 1845. From the Author.

Busby's Journal of a Visit to the Vineyards of Spain and France. By James Busby, Esq. 1838.

A popular Essay upon Comets, by R. W. Haskins, A. M., author of Astronomy for schools. 1842.

Description of the Teeth of a new fossil animal found in the green-sand of South Carolina, by Robert W. Gibbes, M. D., &c. From the Proceedings of the Academy of Natural Sciences. Read June 3, 1845.

Lindsay & Blackstone's Medical and Literary Advertiser. 1845. Northwest corner of Fourth and Chestnut streets, Philadelphia.

The American Journal of Insanity. Edited by the officers of the New York State Lunatic Asylum. Utica, July, 1845.

The Western Journal of Medicine and Surgery. June and October Nos. 1844.

The Literary Record, and Journal of the Linnæan Association of Pennsylvania College. February and August Nos. for 1845. Article I.—A List of Plants growing spontaneously in the vicinity of Quincy, Florida, by A. H. Chapman, M. D. From the Western Journal of Medicine and Surgery. Louisville, Ky.

Geology confirming Divine Revelation. A conversation between a geologist and a student of theology. Received July 25, 1845.

Proceedings of the Boston Society of Natural History. July 1, 1845.

The Buffalo Medical Journal. Edited by Austin Flint, M. D. June, August, September and October Nos. for 1845.

Proceedings of the American Philosophical Society. 2 vols. Nos. 20, 21, 22, 24; Vol. 4, Nos. 31 and 32.

Southern Medical and Surgical Journal. Edited by Paul F. Eve, M. D. and J. P. Garvin, M. D. New Series, Vol. 1, Numbers 6, 8, 9 and 10.

Remarks made at the annual meeting of the Boston Society of Natural History, June 2, 1845. By the President.

Proceedings of the Academy of Natural Sciences, Vol. 1, Nos. 20, 21; Vol. 2, Nos. 6 to 12.

First Annual Report of the Geology of Vermont, 1845; by C. B. Adams, state geologist. Two copies from the Author.

On the Drift Ice and Currents of the North Atlantic, by Wm. C. Redfield. 1845.

A Family Medical Herbal, and Materia Medica Botanica, &c. Illustrated by colored engravings, and edited by Peter P. Goode, A. M., Principal of the Housatonic Institute, New Milford, Conn.

The Botanical Text-book, second edition, by Asa Gray, M. D., Fisher Professor of Natural History in Harvard University. New York, Wiley & Putnam. 1845. pp. 509. From the author.

A new theoretical and practical Treatise on Navigation, by Lieut. M. F. Maury, U. S. N. Philadelphia, 1845. 8vo, pp. 326. From the Author.

European Agriculture and Rural Economy—from personal observation; by Henry Colman. Vol. 1, parts 2 and 3. Boston—London, 1844. From the Author.

Third Bulletin of the proceedings of the National Institute, Washington, D. C. 1845. Also a copy from Hon. W. G. Walker.

The Taconic System, based on observations in New York, Massachusetts, Maine, Vermont and Rhode Island, by Ebenezer Emmons, M. D., Prof. Nat. Hist. in the Albany Medical College. Albany, 1844. From the Author.

Hydrarchus, a gigantic fossil reptile of Alabama. By Dr. Albert C. Koch. New York, 1845.

Description of the Solar Compass, by William A. Burt, Deputy Surveyor, U. S. Detroit, 1844. From the Author.

Ruschenberger's Series. First Books of Natural History. Elements of Geology, by W. S. W. Ruschenberger, M. D.—from the text of Milne Edwards, and Achille Comté. Philadelphia, Grigg & Elliott.

A Dictionary of Medical Terms, by Richard Hoblyn, A. M. Oxford. Philadelphia, Lea & Blanchard, 1845.

History of Wyoming, by Charles Miner.

Religion in America, by Robert Baird. New York, 1844.

Warren on the Preservation of Health. From the Author.

The American Electro-magnetic Telegraph, with the reports of Congress and a description of all telegraphs known, employing electricity or Galvanism, illustrated by eighty one wood engravings, by Alfred Vail, assistant superintendent of the electro-magnetic telegraph for the United States. Philadelphia, Lea & Blanchard. From M. Hart, M. D. and M. A., Washington, December 16th, 1845.

Papers on Practical Engineering, published by the Engineer Department, for the use of the officers of the United States corps of engineers.

Dr. Jared P. Kirtland's Address before the Oberlin Agricultural and Horticultural Society, Ohio.

Magnetical and Meteorological Observations, made at Washington under the orders of the Hon. Secretary of the Navy, dated August 13th, 1838, by Lieut. J. M. Gilliss, U. S. N., Washington, 1845. From J. Davis, U. S. S.

Prof. Emmons on the Taconic System. From the Author.

The Mechanics' Mirror, Robert Macfarlane, editor. Albany, 1846.

The American Journal and Library of Dental Science. Baltimore, 1845.

Essay on Guano, by J. E. Teschemacher. Boston, 1845.

Reports on the Bear Mountain Rail-road, by Edwin F. Johnson and William R. Casey, civil engineers; and on the Coal and Iron Ores of the Bear Valley coal basin, by James Hall. With sections, &c. 8vo pamphlet, pp. 88.

Phrenology Examined, by P. Flourens, member of the French Academy. Translated from the second edition of 1845, by Charles De Lucena Meigs, M. D. Philadelphia. 12mo, pp. 144.

Speculations on Various Scientific Subjects, (connected with chemistry, electricity and vitality,) by Lemuel Lawrence Stewart, A. M., medical student. New York. Pamphlet, 8vo. From the Author.

Address delivered at the close of the 18th annual fair of the American Institute, &c., by the Hon. James Talmadge, Prest. of the Institute. New York, 1845. pp. 16.

FOREIGN MISCELLANY.

The Treaty of Nanking, signed Aug. 29th, 1842, and the Supplementary Treaty, signed Oct. 8th, 1843. Macao, 1844.

Description of a Species of Skate, new to the British Fauna, by John Fleming, D. D., Prof. in the University and King's College of Aberdeen.

Memoirs of the Life of a Country Surgeon. London, 1845.

A Treatise on the Steam Engine, by the Artizan Club. London, Aug. and Oct. 1845.

New and enlarged Gazetteer of Scotland, and Guide Book, by John Parker Lanson, M. A. Edinburgh, 1841. From Mr. Dunlop.

Observations on the Means of promoting the Health of Troops in different climates. By Assistant Surgeon Edward Balfour, Madras Army. April 21st, 1845. London.

Twenty Eighth Annual Report from the Superintending Committee of the London Provident Institution, to the 20th of Nov., 1844.

Royal Society of Northern Antiquaries at Copenhagen, General Anniversary Meeting, Jan. 29th, 1838.

Tal af Akademiens Praeses Herr Iriherre C. G. Von Brinkman. Stockholm, 1843.

Inaugural Lecture, on the opening of the British and Foreign Institute, delivered at the Hanover Square Rooms, London, Aug. 2d, 1843.

Revised Code of Rules and Regulations of the British and Foreign Institute.

Review of a Sketch of a Physical Description of the Universe, by A. V. Hune.

Review of the Vestiges of the Natural History of Creation. Churchill. 4th edition.

DOMESTIC MISCELLANY.

Catalogue of Books for sale by Bangs, Richards & Platt, New York.

The American Book Circular.

Bible Society Record of the American Bible Society, No. 13. Nov. 1845.

Catalogue of the Officers and Students of Amherst College, for 1845–6. From E. Hitchcock.

The Water-cure Journal, Joel Shew, M. D., editor. New York, 1845.

A Catalogue of Officers and Students of Harvard University, for 1845–6. From Joseph Lovering.

A Catalogue of the Officers and Members of the Harvard Natural History Society, founded 1837.

New Series of English School Books. Grigg & Elliott, Philadelphia.

Address of Claimants for French Spoliations.

Catalogue of Valuable Books to be sold at auction, by Howe, Leonard, & Co., at Corinthian Hall, Boston.

The African Repository, November, 1845.

Appeal to the voters of the State of New York, relative to the License Question.

The twenty-ninth Annual Report of the American Asylum at Hartford for the deaf and dumb. From Lewis Weld.

An Address upon injurious Insects, delivered before the Horticultural and Agricultural Societies of New Haven, Oct. 1st, 1845, by Noyes Darling.

Report of the Water Commissioners, 1845, Boston.

Prof. Emmons's Introductory Address, delivered before the class of the Albany Medical College, at the commencement of the session of 1845–6.

Erect Vision from an Inverted Image. From the Author, B. F. Joslin, M. D., New York.

Report of the Secretary of the Navy, Feb. 18th, 1845. From Hon. J. W. Huntington.

Magnetical and Meteorological Observations made at Washington under orders of the Hon. Secretary of the Navy, dated Aug. 13th, 1838, by Lieut. J. M. Gilliss, U. S. N. From Hon. J. W. Huntington.

Report of the Exploring Expedition to the Rocky Mountains, in the year 1842, and to Oregon and North California, in the years 1843–44, by Brevet Capt. J. C. Fremont, of the Topographical Engineers, under the orders of Col. J. T. Abert, Chief of the Topographical Bureau. Washington, 1845. From Hon. J. W. Huntington.

Circular to "Devotional Family Bible," by Alexander Fletcher.

The Reciprocal Obligations of Professors and Pupils, an Introductory lecture, by Thomas D. Mitchell, M. D., November 3d, 1845.

Nineteenth Annual Report of the Trustees and Superintendent of the Deaf and Dumb Asylum of the State of Ohio, for the year 1845. Columbus, 1846.

The Berkshire Jubilee, celebrated at Pittsfield, Mass., August 22d and 23d, 1844.

The Yale Literary Magazine, conducted by the students of Yale College. Vol. X, Nos. 6, 7, 8, and 9.

Further Statement of Facts and Circumstances connected with the Removal of the Author from the Presidency of Kenyon College, in Answer to the Reply of the Trustees, etc., by D. B. Douglass, LL. D. 1845.

Catalogue of Franklin College, five miles from Nashville, Tenn., 1845. From I. N. Loomis. Also Laws and Regulations of the same, from I. N. L.

Bible Society Record, &c., of the American Bible Society for July, 1845.

President Quincy's Speech on the Minority Report of Mr. Bancroft, Feb. 25th, 1845. One copy from Josiah Quincy, Esq.

Remarks on Prisons and Prison Discipline in the United States, by D. L. Dix, 1845. One copy from the Author.

Twenty-ninth Annual Report of the Directors of the American Education Society, 1845. One copy from S. W. Riddel.

Discourse on the Life and Character of the late Hon. Leverett Saltonstall, by John Braser, D. D. May 18th, 1845. From Miss C. Saltonstall.

Twenty-eighth Annual Report of the American Colonization Society, July 21st, 1845.

The True Grandeur of Nations, Mr. Sumner's Oration, July 4th, 1845. From the Author.

Why a National Literature cannot flourish in the United States of North America, by Joseph Rocchietti. 1845.

Our Country—its Origin, Position, and Destination. An Oration, delivered in North East, New York, July 4th, 1845, by Rev. James H. Howe.

Dissertation on Capital Punishment, by S. S. Schmucker, D.D. Third edition. 1845.

An Address, delivered before the Society of the Alumni of Harvard University on their Anniversary, August 27th, 1844, by Daniel Appleton White.

A Letter of John McDonogh on African Colonization, addressed to the Editors of the New Orleans Commercial Bulletin, 1842. From Gen. Cocke.

Speech of His Excellency Roger S. Baldwin, Gov. of Conn., to the Legislature of the state, May, 1845.

History and Record of the Proceedings of the People of Lexington and its vicinity, in the suppression of the True American, from the commencement of the movement on the 14th of Aug., 1845, to its final termination on Monday the 18th same month.

The National Magazine and Industrial Record, edited by Redwood Fisher. Oct. 1845. Published monthly.

The Semicolon, No. 3. Cincinnati, Feb. 1st, 1845.

Rev. Dr. Bacon's Sermon, preached before the Foreign Evangelical Society, New York, May 4th, 1845. From the Author.

Report of the American Temperance Union, 1845.

A Catalogue of the Officers, Faculty and Students of the Genesee Wesleyan Seminary, Lima, New York. 1845.

A Catalogue of the Officers and Students of Middlebury College for the Academic year, 1845–46.

An Address, delivered before the Genesee Philosophic Society, by Rev. F. G. Hibbard, July 16th, 1845.

Prof. Greenleaf's Discourse upon the Life and Character of the Hon. Judge Story, LL. D. From the Author.

A Sermon, delivered August 27th, 1845, at the installation of the Rev. Malcolm N. McLaren as pastor of the First Presbyterian church, Rochester, by William B. Sprague, D. D., of Albany. From the Author.

A Discourse delivered on Sabbath evening, August 17th, 1845, before the Mills Society of Inquiry and the Theological Society of Williams College, by William B. Sprague, D. D., Albany.

Proceedings at the Annual Convention of the Connecticut Medical Society, May, 1845, together with a list of its members.

Annual Report of the Commissioner of Patents for the year 1844. Three copies.—From Hon. H. L. Ellsworth, Hon. J. Huntington, Hon. S. S. Phelps.

Report to the Navy Department of the United States, on American coals applicable to steam navigation and other purposes, by Walter R. Johnson, 1844, Washington. Three copies.—From Hon. S. S. Phelps, J. Huntington, Wm. H. Stiles.

Letter of the Secretary of the Treasury communicating a Report of chemical analyses of sugars, molasses, &c., and of researches on hydrometers, made under the superintendence of Prof. A. D. Bache, by Prof. R. S. McCulloch. From R. S. McCulloch and Hon. J. W. Huntington.

Report of the Secretary of the Treasury communicating a Report of the Superintendent of the Survey of the Coast, showing the progress of the work during the year ending Nov. 1844. From Prof. Bache.

Letter from the Secretary of the Treasury transmitting a letter from Prof. Morse, relative to the magnetic telegraph. From Hon. O. Baker, and from Hon. H. L. Ellsworth.

Historical Collections of Virginia, by Henry Howe. Octavo, pp. 544. Charleston, S. Babcock & Co., 1845. From the Author.

Life and Eloquence of the Rev. Sylvester Larned, by R. R. Gurley. New York, Wiley & Putnam, 1844. From the Author.

Fifty-eighth Annual Report of the Regents of the University of the state of New York. Albany, 1845.

Twenty-fifth annual report and documents of the New York Institution for the instruction of the deaf and dumb, to the Legislature of the state of New York, for the year 1844. Mr. Peet's Letters of instructions and Report on the schools for the deaf and dumb in central and western Europe, by Rev. George E. Day. Albany, 1845. From Mr. Peet.

Twelfth Annual Report of the Trustees of the State Lunatic Hospital at Worcester, Mass. 1844. Boston. From Dr. S. B. Woodward.

The Literary Record and Journal of the Linnean Association of Pennsylvania College, January, 1845. Several numbers.

Catalogue of the Officers and Students of the University of Virginia, 1844–45.

Catalogue of the Union Theological Seminary in the city of New York. 1845.

Catalogue of Plants collected by the Botanical Department of the Providence Franklin Society. 1844.

Catalogue of the Willoughby University, Medical Department, Painsville, Ohio. Jan. 1845.

The Annual Address before the National Institute in the Hall of Representatives, January 15th, 1845, by Levi Woodbury. From F. Markoe, Jr.

Catalogue of the Shells of the United States, with their localities, by C. M. Wheatley. New York, 1845.

A Narrative of the Dissolution of the Medical Faculty of Transylvania University.

The Replier Replied to, and the Reviewer Reviewed, by Charles Caldwell, M. D.

The Charter and Statutes of Jefferson College, Washington, Miss. Natchez, 1840.

Proceedings of the Second Annual Meeting of the American Indian Mission Association, held at Louisville, Ky. 1844.

A Lecture on the Study of Botany, by Dr. Darlington, at Wilmington, Del., 1844.

On the Introduction of Natural History as a regular classic in our Seminaries. An Address before the American Institute of Instruction at Portland, Me., 1844, by Charles Brooks, Esq. Boston.

The American Academic System defended, an address by Pres. Hitchcock at the dedication of the Williston Seminary in East Hampton. Amherst, 1845. From the Author.

The Coronation of Winter, a discourse delivered at Amherst College and Mt. Holyoke Seminary soon after a remarkable glacial phenomenon in the winter of 1845, by Pres. Hitchcock. 1845.

A Review of the Tract Controversy. Fron the Author, Mr. Halleck. New York, 1845.

Duties of Masters and Slaves respectively, a discourse by the Rev. W. T. Hamilton. Mobile, 1844. From the Author.

Lecture on the Indebtedness of Modern Literature to the Bible, by Rev. W. T. Hamilton. Mobile, 1844. From the Author.

The House of God, a discourse by the Rev. W. A. Scott, D.D. New Orleans, 1845.

A Sermon on the Apostolic Succession, by the Rev. James Purviance. New Orleans, 1843.

Inaugural Address before the Mechanics' Institute of New York City, by J. J. Mapes, President, 1845.

Engineer's Report on the survey and primary location of the New York and New Haven railroad. February, 1845.

Prof. Drake's Introductory Lecture on the intellectual improvement of the Medical Profession. Louisville, Ken. 1844.

Introductory Lecture to the course of Theory and Practice of Medicine in Pennsylvania College, Phila., by William Darrach, M. D. Phila., 1844.

Appeal to the People of Massachusetts on the Texas Question.

American Institute. Agricultural Convention, New York, October 11th, 1844. Remarks by the Hon. J. Talmadge on the commercial policy of England, affecting the interests of American agriculture. Two copies—one from Mr. Marsh.

Regulations of Washington College, Charlestown, Maryland. Baltimore, 1844.

Arguments proving the Inconsistency and Impolicy of granting to foreigners the right of voting. Phila., 1844.

Justice to the Memory of John Fitch, who in 1785 invented a steam-engine and steam-boat, by Charles Whittlesey. Cincinnati, 1845.

Report of a Committee of the Overseers of Harvard University, concerning the requirements for admission to the University. Salem, 1845.

Report of the Committee of the New York Historical Society on a National name. March, 1845.

Memorial of John Fitch, being a rejoinder to a Memorial placed before the Senate, by Charles Gould.

A Sermon delivered at the opening of the new church erected by the First Presbyterian congregation, Lansingburgh, by William B. Sprague, D. D. 1845. From the Author.

DOMESTIC NEWSPAPERS.

Daily National Pilot, Buffalo, Feb., 1845, with a notice of this Journal, do. March 8th, containing an account of welding steel by friction and pressure, 24th—31st. Concordia Intelligencer, Vandalia, May 17th, 1845, Feb. 15th. Goshen Democrat and Whig, May 18th. Christian Register, Boston, April 12th. Daily Ohio State Journal, Jan. 29th, from M. Barrett, a notice of Mr. St. John's class in geology. New York Spectator, Feb. 22, notice of Kaleidoscope photography. Christian Guardian, Toronto, Feb. 26. Weekly American Advocate, April 5th. Dayton Transcript, Ohio, March 1st, with a notice of this Journal. Extra Morning Sentinel, Sarycuse, March 7th. Ottawa, Ill., Free Trader, with a notice of a comet. Pennsylvania Inquirer, May 5th, 1845. American Republican, Jan. 8th. Harmony of Science with Religion. Long Island Star, Nov. 20th, 1844. Republican, Petersburg, Virginia, Dec. 4th. The Lutheran Observer, Baltimore, Jan., 1844, contains a notice of Prof. Hall's death. Daily National Pilot, Buffalo, April 25th, contains a notice of this Journal. Evening Transcript, April 29th, Boston. Cambridge Chronicle, Md., with a notice of the Dorchester Farmers' Club. National Intelligencer, Washington, April 25th, with a notice of this Journal. True Whig, Goshen, N. Y., notice of the late Dr. Horton. Michigan State Journal, Ann Arbor, with the governor's message. Cherokee Advocate, Tallequah, Cherokee Nation, Thursday, Nov. 21st, 1844. Friends' Weekly Intelligencer, Phila., a series. Quarterly Paper of the Foreign Evangelical Society, Nov., 1844. American Messenger, May, 1845, New York. Richmond Inquirer, containing the Valedictory Address of Prof. J. Millington, William and Mary College. Herald of the Times. Springfield Republican. Gist's Advertiser, Cincinnati. The Weekly American Eagle. New York Journal of Commerce. Temperance Standard. Daily National Pilot, July 23d, 1845; an article on the mineral, fossil and metallic resources of our country. Western Star, Aug. 15th, 1845. The Scioto Gazette; an article on American Antiquities. The Sandusky Clarion, Oct. 10, 1845. Saturday Courier, Nov. 15, 1845, Phila. Free State Rally, Nov. 15, 1845, Boston. Cleveland Daily Plaindealer, Nov. 12, 1845, with a notice of the Museum of Natural History. The Wall Street Reporter, New York, Nov. 20, 1845. The Long Island Farmer, Jamaica, N. Y., Nov. 18, 1845. Artist and Artizan, Cincinnati, Oct., 1845. Prospectus of an improvement of the Scioto Gazette. The Christian Freeman, Hartford, July, 1845. Free State Rally and Texan Chain Breaker, Boston, Dec. 6, and Dec. 13, 1845. Rochester Daily American, Dec. 10, 1845. Memphis Intelligencer and Semi-monthly Family Gazette, from John Pope, contains an Agricultural Report, Memphis, Tenn., Nov. 26, 1845.

FOREIGN NEWSPAPERS.

Glasgow Citizen, Glasgow, Jan. 4th, 1845, from Mr. Combe. The Morning Sun, May 15th, 1845. London. The Witness, Edinburgh, Aug. 30, 1845. Edinburgh Advertiser, Aug. 5, 1845. The Times, London, July 2, 1845. The Oxford University City and County Herald, Nov. 1st, 1845. Supplement to the Oxford Herald, Nov. 1st, 1845.

ANNOUNCEMENT OF RECENT WORKS OF SCIENCE.

Zoological and Palæontological Works of M. Alcide D'Orbigny.

Paléontologie Française, or Zoological and Geological description of the fossil Mollusca and Radiata of France. First part, *Terrains Cretacés*; ninety eight numbers, containing 379 plates, have appeared. Second part, *Terrains Jurassiques;* thirty one numbers, containing 124 plates, are out. In each work the numbers contain 4 superb lithographic plates, with the text corresponding. Price out of Paris, 1 f., 35 cts.

Paléontologie du Voyage dans l'Amérique Méridionale, 1842. 1 vol. large 4to, 188 pp., 22 pl.

Coquilles et Echinodermes fossiles de Colombie, recueillis par M. Boussingault, 1842. 1 vol. 4to, 64 pp., 6 pl.

Considerations générales sur la Paléontologie du Voyage dans l'Amerique Meridionale. 1 vol. large 4to, 188 pp., 22 pl.

Considerations générales sur les Coquilles et les Echinodermes fossiles de Colombie, recueillis par M. Boussingault, 1842. 1 vol. 4to, 64 pp., 6 pl.

Monographie des Céphalopodes cryptodibranches, par MM. Férussac et A. D'Orbigny. 4to, with 130 colored plates. 1839 –40.

Mollusques des Canaries, in large 4to, 117 pp., 8 colored plates. 1839. With a description of the Canary Isles, by MM. Webb and Berthelot.

Polypiers du Voyage dans l'Amerique Meridionale. 14 plates appeared in 1843.

L'Homme Américain (l'Amerique Méridionale) considéré sous les rapports physiologiques et moraux. 2 vols. 8vo, with plates. 1839.

Mammifères de l'Amerique Meridionale, publiés en commun avec M. Gervais. With plates.

Oiseaux du Voyage dans l'Amerique Meridionale de M. D'Orbigny, in large 4to, with numerous plates.

Ornithologie de l'ile de Cuba. 1 vol. in large 8vo, 336 pp., with a folio atlas of 33 plates. Translated into Spanish, and forming part of the history of the island of Cuba, by M. Ramon de la Sagra.

Reptiles du Voyage dans l'Amerique Meridionale, publiés en commun avec M. Bibron, in 4to, with 15 colored plates.

Poissons du Voyage dans l'Amerique Méridionale, publiés en commun avec M. Valenciennes, in 4to, with colored plates.

Geologie du Voyage dans l'Amerique Meridionale. 1842. 1 vol. 4to, 289 pp., with many fine charts and sections.

Besides the above works, D'Orbigny's Memoirs in the Annales des Sciences Naturelles, Revue Zoologique, Mémoires de la Société Géologique, Magasin de Zoologie, Mémoirs de la Société d'Histoire Naturelle de Paris, are numerous and important; among them we may allude here to the following:—In the *Annales des Sciences Naturelles*, xviii, 1843, a memoir on Belemnites; xvi, 1841, on the Ammonites of the Cretaceous formations; xvii, on two new genera of fossil Cephalopoda; xix, on the Gasteropodous Mollusca of the Cretaceous formation; xv, Zoological and Geological considerations on the Radiata; *Revue Zoologique*, 1839, t.ii, Note sur le genre Caprina.

Description des Mollusques terrestres et fluviatiles du Portugal, par Arthur Morelet. 1 vol. in 8vo, with 14 colored plates. Paris.

Voyage en Abyssinie, exécuté pendant les années 1839–43, par une commission scientifique, consisting of MM. T. Lefebvre, Lieutenant, A. Petit and Quartin Dillon, Naturalists. The work is in the course of publication, and will consist of 34 numbers, consisting each of 6 plates, (12 fr.,) and 12 numbers, each a half volume of text, (7 fr.)

Die Organisation der Trilobiten aus ihren lebenden verwandten entwickelt; von H. Burmeister, &c. 6 copperplates. Berlin, 1845.

Flora Antarctica, or the Botany of the Antarctic Voyage of the Erebus and Terror, 1839–43, is in the course of publication.

Sibthorp's Flora Græca, or descriptions of rare plants from the Grecian Archipelago, by J. E. Smith and J. Lindley. 10 vol., royal folio, containing 1000 beautifully colored plates. The expenses of this splendid work were upwards of 30,000 pounds, and were defrayed from the proceeds of an estate left by M. Sibthorp for that purpose. As only thirty complete copies were sold, each cost the estate upwards of a thousand pounds. The original price, 240 guineas, is now reduced to 40 guineas, as the plates have been loaned to the publisher without charge.

Stephens' Entomology. The seventh volume of the Mandibulata, may be now had complete.

History of British Crustacea, by Thomas Bell. Part iv is announced.

The *British Desmidiæ*, with colored figures of the species, preparing for publication, by J. Ralfs. Price to subscribers one guinea.

Taylor's Scientific Memoirs. Part xiv contains:—

Holtzman, on the Heat and Elasticity of Gases and Vapors, and Theory of Steam Engines. Magners, on the Expansive Force of Steam. Berzelius, on the Allotropy of Elementary Bodies. Emmerich, on the Morphology, Classification and Distribution of Trilobites. Biot, on Polarized Light.

ASSOCIATION
OF
AMERICAN GEOLOGISTS AND NATURALISTS.

The next Annual Session of this body will be held in the City of New York, on the 2d of Sept. 1846, (Wednesday,) and one week thereafter.

Dr. C. T. Jackson, Chairman.

Mr. B. Silliman, Jr., Secretary.

Standing Committee for the next meeting.

Dr. C. T. Jackson.
B. Silliman, Jr. } *ex officio.*
E. C. Herrick.

Amos Binney.	Wm. C. Redfield.
Prof. H. D. Rogers.	James C. Booth.
Prof. B. Silliman.	John L. Hayes.
Pres. E. Hitchcock.	James D. Dana.

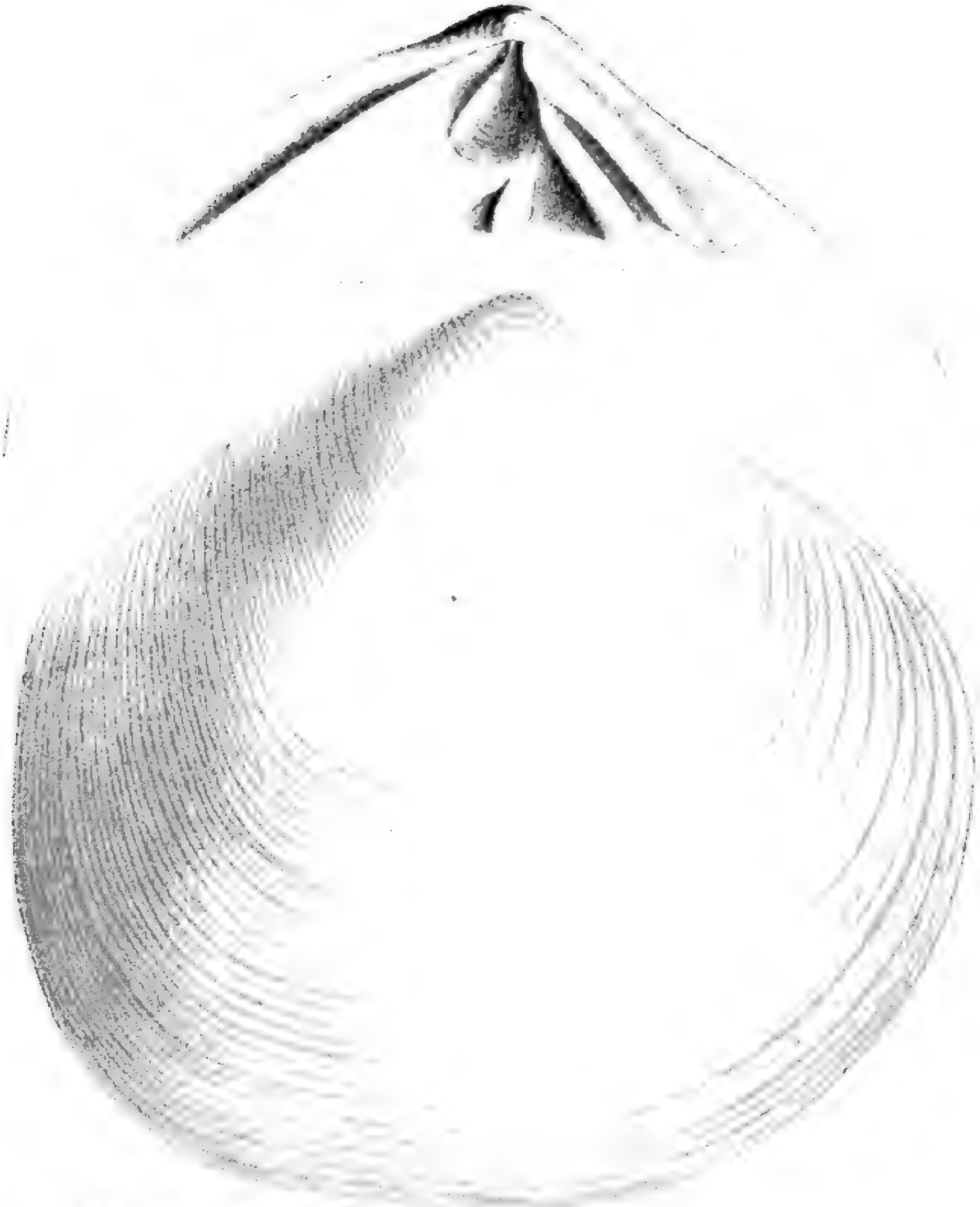
Local Committee for the next meeting.

Hon. James Talmadge.	Prof. John W. Draper.
Hon. Luther Bradish.	H. Brevoort.
Maj. Joseph Delafield.	Charles M. Wheatley.
Prof. James Renwick.	Com. Matthew C. Perry.
Prof. James E. DeKay.	C. Congdon, *Brooklyn.*
Jeremiah Van Rensselaer, M.D.	James Hall, *Albany.*
Prof. Cyrus Mason.	W. B. Kinney, *Newark.*

Abstract Report of the Proceedings of the Session in May, 1845, at New Haven.

This Report is now ready for distribution to members, it is a well printed pamphlet of about 90 pages, and may be had of the Secretary, (B. Silliman, Jr.) Five copies for $1, single copy 25 cts.

Conrad's Eocene fossils. No. 3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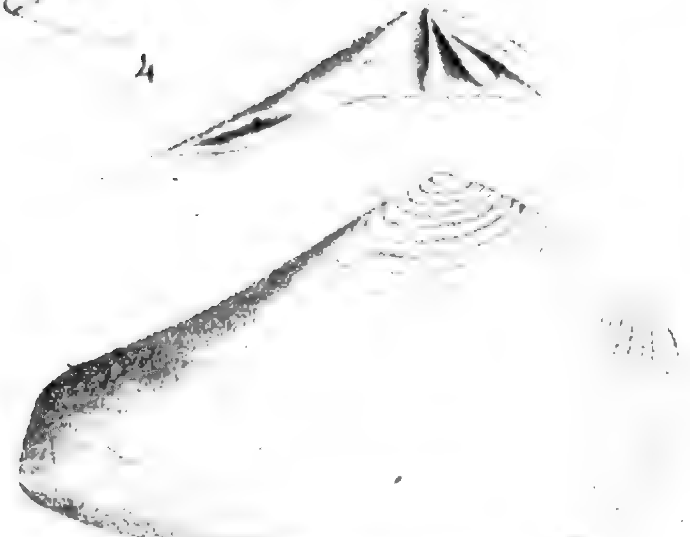
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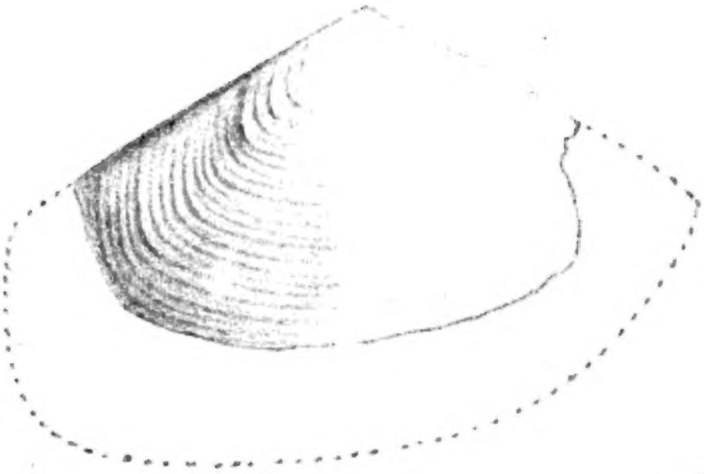
Conrad's Eocene fossils No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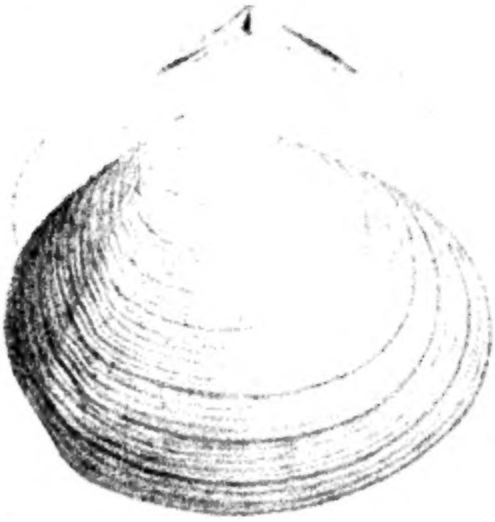
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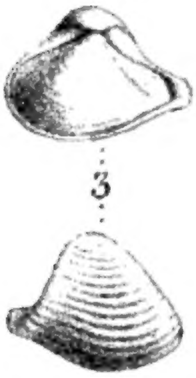
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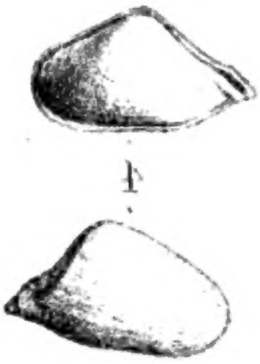
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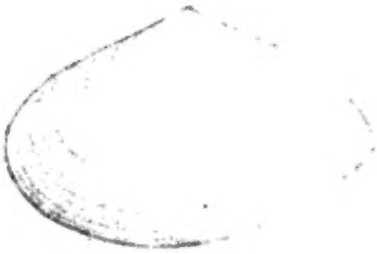
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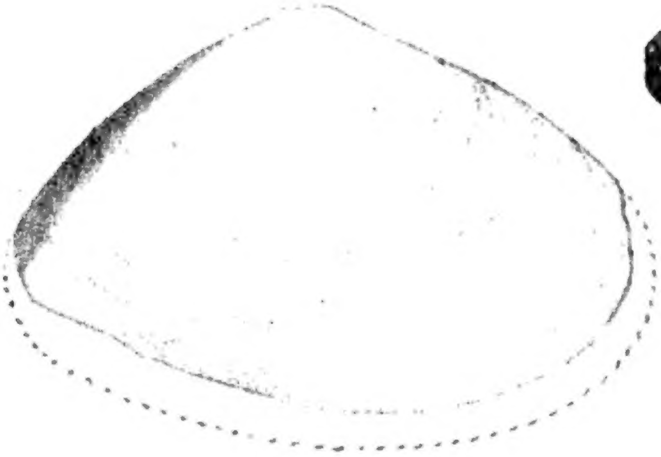
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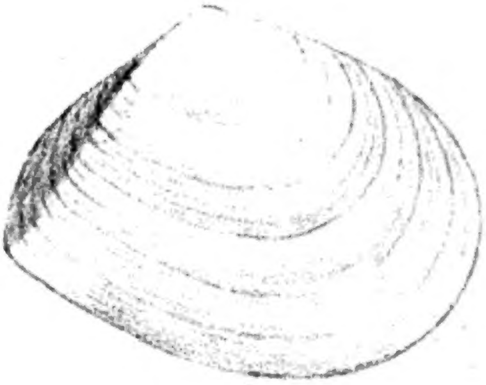
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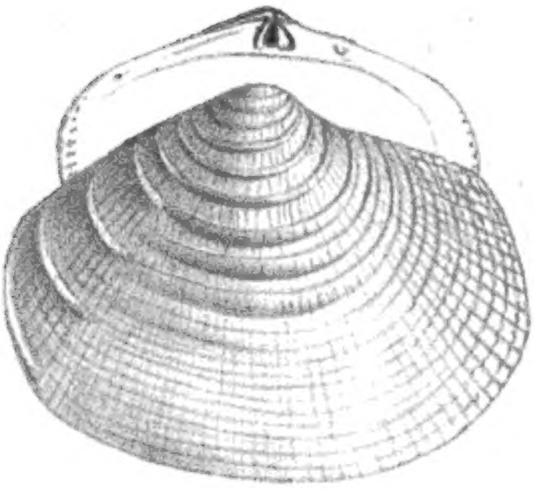
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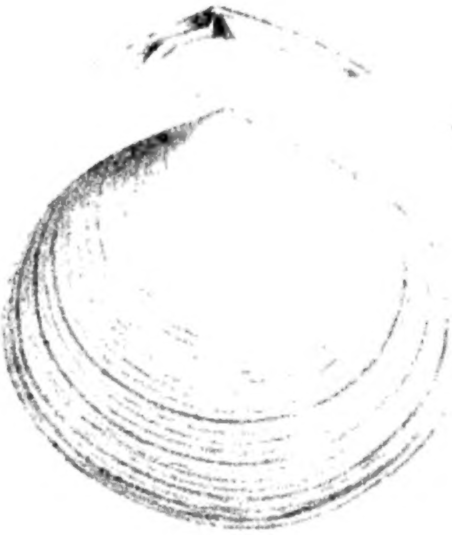
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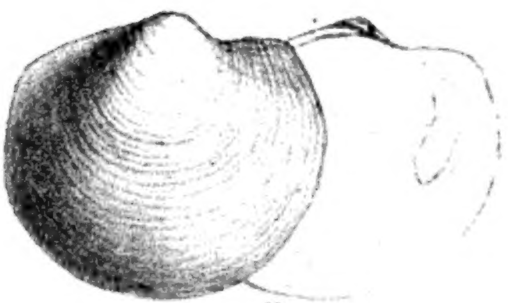
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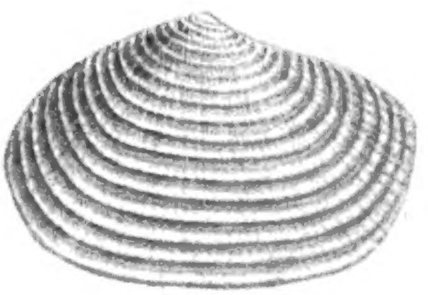
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